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(54) PACKAGING CONTAINER WITH OVERPRESSURE RELIEF, PACKING METHOD AND SYSTEM

VERPACKUNGSBEHÄLTER MIT ÜBERDRUCKABLASS, VERPACKUNGSVERFAHREN UND SYSTEM

RÉCIPIENT D'EMBALLAGE AVEC VALVE DE SURPRESSION, PROCÉDÉ D'EMBALLAGE ET SYSTÈME

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(56) References cited:
EP-A1- 0 767 105
DE-A1-102007 022 400
US-A- 6 010 244
US-A1- 2004 188 310
US-A1- 2005 281 493

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EP 2 493 779 B1

Description

TECHNICAL FIELD

[0001] The present invention relates to the packaging of granular bulk solids, containing fine powder, into plastic bags, and particularly to methods and plastic packaging containers such as bags useful for such packaging, preferably in the industrial packaging of pulverulent bulk solids, like cement, into heavy duty shipping bags.

BACKGROUND OF THE INVENTION

[0002] Products containing fine powder components, such as cement, tile adhesives, dry concrete mix, lime powder, dry milk, cocoa etc., are known to be bagged mixed with air, i.e., in a form of an air-solid mixture. As it is known, at the moment the filled bag is closed, the bag contains more air than the granular solid material, therein, would store in its finally compacted state. Therefore such packages must be compacted so that they can then be safely palletized. That makes it necessary to conduct air out of the bags after they are filled and closed. Bags made of polymer film have several advantages (e.g. strength, waterresistance, good printability, light weight, low price, possible compatibility with automatic low cost and fast form-fill-seal /"FFS"/packaging, good recyclability etc.) over paper but their problem is that their walls are impermeable to air, therefore they are well known to need to be provided with some venting means for letting the entrapped air out of the bag on the one hand and simultaneously retaining powder contents in the bag, at least partly, on the other hand. The typically used venting means comprise a venting air-channel provided between two film plies, both the inner and outer film plies being perforated for breathing on the one hand, and the perforations preferably being provided in an offset or staggered manner to force the air to be conducted along a winding path in the air-channel, for dust retaining, on the other hand. The vent is always used in the top bag wall panel of the package so that it can conduct out the air which is always collected in the top region of the package. It means that in practical use the package must be suitably oriented for venting, with its vent being on top. Good examples are provided in patent documents US 3,628,720 and EP 1600 399. It is popular to use spacer means (e.g. projections, embossing, indentations, crimping, fibrous filter sheet etc.) in the vent's air-channel in order to better maintain a free path for the airflow therein. It is known that small perforations, that are needed for effective dust retaining, can unfortunately be plugged by the dust thereafter not allowing the air to evacuate, as is discussed for example in document US 20070248291A1 which provides, as a solution, a filter sheet between the powdery product and the exit perforations to accumulate the dust and retain it from the exit perforations in order to maintain the air permeability of the exit perforations. The skilled person will primarily want to fill and palletize as fast as possible. Fine powder products are traditionally known to be time-efficiently packed in valve bags, mainly of porous paper but partly also in vented plastic valve bags. Every prior art document we know of, dealing with the filling of aerated fine powdery products into polymer film bags provided with vent means, teaches to do the filling as fast as possible and, in order thereof, to use, as much as possible, the dustretaining vent means of the polymer bag for conducting the excess air out of the bag already during the filling operation, as for example in German utility patent DE8133295U1, US 2007/0248291A1, US 3,937,395, EP 0444261B1, US 5,493,844, US 4,441,209, US 4,930,904, US 4,672,684, German utility patent G9110645.1U1, DE4033499A1, WO 88/08816, WO 2005/092724A1 and US 4,759,641.

[0003] Patent application US 20050281493A1 deals with the packaging of fine-dusty and moisture-sensitive granular products, and sets the goal of fulfilling the demand for a lowcost packaging container, for building materials, cement and similar aerated materials, which container can reliably protect these products from contamination and moisture and relieves the overpressure, typical of these products, during and/or after said products are filled in. The document does not mention any respects in which relieving the pressure during the filling would be better or worse than relieving the pressure after the filling and as concerning "after the filling" it does not mention any waiting after the filling before pressure is started to be relieved. The document solves the problem with a packaging container, comprising: a flexible plastic wall which comprises a region having an interior wall and an exterior wall, said region being defined by means of at least one sealed or glued seam, wherein the interior wall comprises one or more openings having a size sufficient to allow gas to escape from an interior portion of the container and to enter into the region between the interior and exterior walls, wherein said at least one sealed or glued seam defining said region has in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to a predetermined pressure. The document does not mention any particular value as for the said predetermined pressure, but the solutions, taught therein, of weakening the seam (such as Corona pre-treating, applying a partial release layer of lacquer etc.) make it possible for the skilled person to technically freely select any desired seam strength level from zero to hundred percent closing strength. The document teaches that there are adhesive forces in the weakened seam and only if the adhesive forces in the weakened seam are overcome by a difference in pressure, such as the overpressure developing during or after filling, will the seam open and release said overpressure, thus venting the bag in a controlled manner. The document teaches to prefer form-fill-seal (hereinafter referred to as "FFS") packaging for its low cost. According to the document, its plastic bag reliably protects packed products from contamination and/or moisture getting into the bag because the venting seam (unlike earlier vent exit open-

ing solutions, always being uniformly open) only opens due to a certain overpressure which can only arise from inside the bag (during as well as after filling) but evidently never, in practice, from outside the bag. The document says that contaminants can not enter the interior region since, after the overpressure has been relieved, the interior and exterior films are arranged tightly on top of each other, being fixed in this position by adhesive forces. Also, the document teaches that even the escape of very fine particles from the bag is practically impossible through the weakened seam, which can be attributed to the fact that the adhesive forces acting between the films, which are only in part firmly connected to each other, produce a certain degree of adhesion even without a securely sealed or glued connection and thus the venting seam is partially gas permeable. In summary, the vented bag of US 20050281493A1 is taught to prevent dust from leaving the bag and moisture from entering the bag, apparently at selecting any predetermined, positive limit-value of overpressure at which the vent seams are designed to open in a controlled manner.

[0004] Patent application US 20080257450 A1 provides an "FFS" packaging apparatus that appears to satisfy a long-felt market demand making the throughput of "FFS" packing of fine powders into open top bags competitive with that of the known porous paper valve bag technology. The objective of the document is a form-fill-seal packaging apparatus for filling aerated fluidized powder products into open top bags fast. It is clear from the document that with using a sufficient number, for example 10 or more, of rotating filling sub-units, the overall output of the packaging can be very high (probably as high as with FFS packaging of non-dusty solids) and can be estimated by a skilled person to possibly reach a cycle time as short as about 3 to 4 seconds per package. In the solution of the document, during the filling the open-top bag is not pressurized (i.e. the top surface of the contents is only exposed to normal atmospheric air pressure) up to the moment at which the top of the suspended bag is closed with welding.

US 2004/188310 and DE 10 2007 022400 disclose packaging containers, however, the suggested containers differ from the containers defined by the claims of the present patent application.

THE OBJECTIVE OF THE INVENTION

[0005] We believe that our present invention is largely based on the formulation of a new problem to be solved, whose solution then needs measures contrary to the technical prejudice. The following has lead us to elaborating the objectives of our invention.

[0006] Technical prejudice concerning packing methods, based on the prior art, will prompt the skilled person, faced with the problem of using plastic bags for the packaging of aerated, pulverulent, fine bulk solids, to:

- endeavor to fill and palletize as fast as possible, possibly as fast as with full-porous paper valve bags,
- use plastic bags with dust retaining venting means, e.g. multiwall air-channels, capable of letting out as much air as possible and capable of retaining and holding as much fine dust as possible without getting blocked,
- in order of an earliest starting of compacting the powder contents, conduct, as soon as possible (possibly continuously during as well as after the filling) as much air as possible from the bag to the environment through the aforementioned venting means,
- exploit, as much as possible, the dust-filtering capability of the aforementioned venting means during and after filling, in order of a clean work environment and package,
- close the filled bags and stack them as soon as possible, and use the aforementioned venting means to remove (e.g. by squeezing), as soon and as fast as possible, enough of the residual surplus air from the closed bag in order of a sufficiently compacted bag that can already be stacked safely,
- make it possible for all residual surplus air to perfectly be removed from the packages in the long run (practically: let the stacked packages of the finished pallet load slowly, essentially perfectly, deflate by themselves in response for example to the weight of the bags' loose walls pressing the last quantities of air out of the bags through the ever-open vent means) because even small amounts of entrapped air can later (typically during transportation causing vibration in the pallet load) potentially cause a re-fluidization of the bag contents and thereby a sudden destabilization of the pallet load as well as a possible later precipitation of moisture from the entrapped air that could be harmful to the contents (e.g. to cement).

[0007] Multiwall venting air-channels, as described hereinabove, have been used in order that fine powder product components be prevented at least partly from getting, together with the air, out to the environment. These venting channels capture and retain dust and therefore they will necessarily accumulate and contain more or less dust in the end. That fact is confirmed, for example, in patent document US 3,628,720. As we also illustrated hereinabove, the fact that venting air-channels accumulate in themselves dust, only appears as a problem in the prior art either with respect to a potential blocking thereof (which stops venting) or because dust can potentially get out to the environment. In response, prior art solutions endeavor, on the one hand, to increase the dust holding capacity of the venting channels (e.g. by using the possible longest vent channels as in US 20050281493A1) and, on the other hand, to prevent dust in the venting channel from getting out therefrom to the environment (e.g. by adhesive forces, acting between the films attached with the partially gas permeable exit venting-seam, producing a certain degree of adhesion and retaining even the finest particles, as taught in US

20050281493A1). For example, US 20050281493A1 explicitly says that any penetration of powdery product contents into the venting channel region is harmless, since such product can hardly exit through the partially gas permeable sealed seam. Otherwise the skilled person who follows the technical prejudice will not be worried about the quantity of dust captured and held within the double-wall venting channel of a bag.

[0008] We, however, consider the quantity of the said captured dust, typical of the prior art practice, unacceptable. We have recognized several drawbacks of the prior art caused by the too much captured dust. The quantity of fine powder product finally contained in the dust retaining venting means of the bag (hereinafter referred to as the residual powder), is lost for the customer. Though its proportion in the filling weight is not too high, it is still a part of the filling weight, and it costs money, but the end user is unable to pour it out of the bag because it is stuck into the venting channel. Therefore the residual powder remains in the emptied bags, and is disposed of, anyway contaminating the environment with many tons of solid waste. It also makes recycling of the used bags difficult. Used thermoplastic packaging bags can simply be re-extruded into pellets. Prior to re-extrusion, re-collected plastic bags are chopped into pieces or flakes which are then washed in water in order that any heavier dirt, attached inside and outside the pieces of bag wall, be gravity-sorted from the polymer (i.e. sink in the water). The thermoplastic film pieces are then dried and fed into an extruder where the plastic is melted and pressed through a metal mesh filter, positioned at the exit of the extruder, in order of removing any foreign material from the thermoplastic before its re-pelletizing. In case of the currently discussed prior-art bags, however, among the chopped film pieces there are many pieces from the double-layer venting channels, containing dust contamination embedded between the two abutting film plies, which is not washed out of the polymer material. Therefore the residual powder also enters and travels along the extruder and is finally retained in the mesh filter which is a drawback because it necessitates frequent filter changes in spite of a careful pre-washing. An even much bigger problem, however, is caused if the residual powder is of a hard, abrasive material (e.g. cement, minerals, stone, ores, metals, glass etc.) because it (passing along the extruder before getting caught in the filter) wears out the extruder (both barrel and screw) extremely fast. The costs thereof are even much higher than those of frequent filter changes. In case of the most popular bulk solid products, like building materials, the price of the packaging bag makes up a surprisingly considerable part of the price of the relatively inexpensive packed product. If the emptied, used plastic bags were essentially free of hidden stuck-in dust, they would be a more valuable re-collectable raw material for recycling companies, which would add much market value to the original packed product, too. We believe that a packaging of an improved quality, i.e. that resulting in decreased quantities of accumulated residual powder stuck in the bags' walls, is desirable even though it can cause a somewhat lower packaging throughput due to somewhat lengthened cycle times of filling, bag closing and/or palletizing. These latter drawbacks are merely quantity, rather than quality, issues and can, for example, be eliminated with installing further packaging apparatuses.

[0009] It is our objective to provide a method for packing pulverulent bulk solids into vented plastic bags, including conducting air through dust retaining venting means out of the bags after they are closed, which method helps to pack with reduced quantity of residual powder contained in the venting air-channels of the bags and thereby helps to eliminate the drawbacks caused thereby (i.e., loss of material for the user, pollution of the environment, increased costs of filtering in the recycling, accelerated wear of the recycling extruder). We believe that the setting of such an objective, based on our formulating a new problem to be solved, is in itself novel and non-obvious.

[0010] It is also our objective to provide a plastic packaging container that is especially suitable for use with our invented method, especially with preferred embodiments thereof, and which, in particular, has improved dust retaining venting means suitable to help to vent the bag with a reduced quantity of accumulated residual powder. It is also our objective to provide systems comprising novel plastic packaging bag and granular contents packed therein.

DESCRIPTION OF THE INVENTION

[0011] We consider the aforementioned document US 20050281493A1 as closest prior art. We intend to improve its solution in a manner contrary to the technical prejudice. The general technical prejudice, discussed hereinabove, prompts the skilled person, intending to implement the teachings of US 20050281493A1, to select, at forming the plastic bag, a positive but otherwise definitely low predetermined limit-value of overpressure at which the vent seams are designed to open. Namely, on the one hand, any positive value is taught/suggested in the document US 20050281493A1 to be equally useful to keep external moisture and contamination out of the bag and retain even the smallest dust particles in the bag, keeping the work environment clean. On the other hand, the skilled person will realize, that selecting a lower limit-value of seams-opening overpressure will make venting the bag faster and easier which is enough to prompt the skilled person to select a limit-value of overpressure as low as possible. The skilled person, taught by US 20050281493A1 to prefer FFS packaging for its low costs, intending, for example, to use the state-of-the-art apparatus of US 20080257450A1 for FFS-packing powdery goods into the plastic bags of US 20050281493A1 will try to deflate the bags as fast as possible in order to minimize the cycle times and maximize the palletizing speed, all in order to keep up with

the very high output of the apparatus. In addition, the skilled person will also realize, at least by trial and error, that the higher the limit-value of overpressure necessary for opening the seams is, the more entrapped air may remain in the package in the long run. As we said, palletized packages must, according to the technical prejudice, be able to vent also after the stacking, which means that they must be able to reach their full compactness already in the pallet load. Since the packages are typically individually compacted, squeezed, to an almost full compactness prior to their stacking, only a small amount of surplus air remains in the packages at the time they are palletized, but even that small quantity of air is known to be necessary to be removed for full security of the product and of the transportation as we said hereinabove. Therefore, according to the prior-art prejudice as well as according to paragraph [0030] of US 20050281493A1, a venting of the stacked packages is necessary. Such a venting necessarily means a venting of definitely small quantities of air, which can only build an extremely low overpressure. (N.B.: In a palletized stack the weight of the load is held by the compacted solid granular product thus the load weight does not directly develop an overpressure in the bags, unless the packages are re-fluidized by, for example, a vibration from transportation. That is why the residual air should utterly be removed from the stacked bags before such a re-fluidization could take place.) Therefore in this important final (i.e. in-the-stack) phase of the venting the venting must inevitably happen in response to very low overpressure values. Namely, vented plastic bags prior to US 20050281493A1, those with vents venting without any pressure limit-value, would essentially surely and fully deflate, after the stacking, by themselves in the long run in response to the weight of the upper packages and mainly because even a mere weight of the loose top bag wall could expel essentially all surplus air from the package in the long run. The special feature, taught in US 20050281493A1, of an only partially weakened venting seam, taught to have a certain degree of adhesion, resulting in a predetermined necessary pressure limit-value, however, can make a spontaneous self-venting of the package stop too early, i.e. at a certain residual limit-air-content. The lower the pressure limit-value is, the lower the potential residual limit-air-content is, i.e. the safer the packaging is. A nearly zero pressure limit-value provides packages nearly as compact as those with bags without a venting pressure limit. A similar or analogous phenomenon can be observed: if we leave an inflated plastics toy, like a plastic boat, with a fully open air valve, the toy will be able to completely deflate and collapse by itself by time, but if we put something in the air valve that closes it below a certain pressure level, the toy will remain inflated to a certain degree and it will be rather difficult to deflate it (e.g. by squeezing) perfectly. To sum it up: nothing in the prior art would prompt the skilled person to select a relatively high pressure value for the predetermined overpressure at which the vent seams are designed to open.

[0012] We, however, recognized that in a packaging process it is, (just contrarily to technical prejudice), beneficial with respect to our objective if the controlled venting of the plastic container taught in US 20050281493A1 is exploited in a novel manner, which means that the bag is formed to have vent seams that allow gas to first escape only at a relatively high internal pressure. We recognized that this feature can be used in order of suitably delaying the starting of the venting of the aerated package after the bag is filled and closed, which is beneficial based on the following. While a product, containing fine powder (e.g. lime powder, cement, tile adhesive, dry concrete mix, milk powder etc.), is being filled into a bag mixed with surplus air, the filled-in contents of the bag typically comprise an essentially homogeneous fluid even if the filling is done without the aid of transportation air. In the practice of valve bag filling as well as of FFS filling, essentially immediately after the closing, the package is placed on a surface in a lying position, i.e. it is typically laid down, with a relatively large impulse, on a table, a conveyor or any similar surface, which can be horizontal or inclined. After the moment of this laying of the package the solid contents are inevitably mixed with the air contents both together forming a homogeneous fluidized mass behaving like water, or a very thin paste, and filling up the inner filling-space of the bag. Also, the laying down of the package usually generates therein an internal pressure higher than before, i.e. higher than when the bag was suspended and/or supported and being filled. This is usually due to the shape of the bag being changed, i.e. due to the surface/volume ratio of the bag being higher at its brick-like shape in the laid-down position than at its more sphere-like or more cylinder-like shape in a (usually suspended and/or propped-up) filling position. Namely the size of the outer surface of the bag is essentially constant and its available volume gets smaller. In fact its available volume in its said brick-like form is usually designed to only be sufficient for the compacted solid contents rather than for the aerated contents and that pressurizes the aerated package when it is laid down. At the moment the package is laid down, earlier traditional (i.e. prior-to-US 20050281493A1) venting means (i.e. those always releasing any gas available for escaping thus venting in an uncontrolled manner as compared to the controlled manner of US 20050281493A1) immediately start to vent the bag and vent it fast, due to the relatively high initial internal overpressure. Such a venting is relatively intensive at its beginning, later losing intensity as the pressure drops as the bag gets deflated. All this is quite common in the prior art and is very good for an early and fast compacting of the package, but it also means that the most volume is removed from the bag by venting just when the contents are the most fluidized, which results in much of the fluidized air-solid mixture (which is actually extremely dusty air) flowing through the venting air-channel of the bag which filters out, and unnoticedly accumulates, the powder contents of the fluid flown through it. The result is an inevitable

and invisible contamination of the bag. The same is the case with a plastic bag having a pressure-selective vent as taught in US 20050281493A1 if a low seam-opening limit-pressure value is selected in it as in accordance with the technical prejudice: the vent starts to conduct air essentially as soon, or almost as soon, as the overpressure starts to build up in response to the bag being reshaped and its contents being rearranged. We recognized that it is beneficial in the packaging process if we form a bag, for example a bag of US 20050281493A1, selecting a seam-opening limit-pressure value higher than the pressure which is generated in the aforementioned laid-down package. For example: the FFS apparatus of US 20080257450A1 provides essentially zero overpressure above the level of the fluid contents of the bag at the moment it is closed in a suspending orientation. A moment later, the package is released from the suspending and supporting and is suddenly turned to lie down which, on the one hand, horizontally equalizes and stirs up the contents and causes the whole internal space of the bag to essentially be full of homogeneous fluid (air-solid mixture) and which, on the other hand, creates a definite overpressure in the bag which is then maintained in the absence of any essential venting, in accordance with our recognition. As the vents resist the internal overpressure, not any air leaves the bag, not any air enters the air-channel. As the package lies at rest, or, even better, is suitably, subtly vibrated e.g. at its part on which it lies (i.e. its momentary bottom), the solid material immediately starts to separate from the air-solid mixture. By time, powdery contents settle in the said bottom of the package and air rises into the top region thereof. During this (spontaneous or vibration-enhanced) separation process a (generally horizontal) phase border appears in the bag between the two (gas and solid) phases and gets more and more definite. The air, above it, gets clearer and clearer and the granular product, under it, gets more and more compacted by time. At the end of such a separation process there is a bubble of definitely pure air above the definitely compacted granular product in the bag. The speed of the separation in an unvented package, according to our observations, depends on several factors like the kind of the granular material, e.g. how much and how fine powder it contains and its general mixability with air, the air content at start, the presence and quality of separation-enhancing vibration etc.. The separation appears to be relatively fast at, and right after, the start of the separation-process, i.e. the moment the bag is left lying after it has been closed, dropped and laid down. By every second's time, spent without venting, the air in the top region of the package (from which it is then to be conducted out) gets clearer. During this separation process, the later we conduct a quantity of air out of the top region of the package, the purer the said conducted quantity of air will be. The more we wait before we essentially vent, the less the residual powder in the bag's venting air-channel in the end will be. When the air bubble in the bag is already clear enough, we can, for example, compress (for example both vertically and horizontally) the package to create in it an internal pressure high enough to open the vent seams and expel an essential quantity of air out of the package.

[0013] The essence of our method invention is **a packing method** in which

- o a granular product is provided, and
- o a package is produced, the package comprising a packaging bag and the package further comprising a quantity of the granular product mixed with a gas, packed into the packaging bag,
  - o the packaging bag comprising a flexible plastic wall which comprises a vent for venting the bag in a suitable venting orientation of the bag by conducting gas from an inside of the bag into an air-channel and from the air-channel to an outside of the bag,
    - ■ the vent having air-channel-walls defining the air-channel, and
    - ■ the vent having internal venting means for conducting gas from inside the container into the air-channel, and
    - ■ the vent being at least partly defined by means of one or more sealed or glued seams having in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to a suitable pressure, and
  - ○ the package is reshaped by at least partially rearranging its contents, for providing the bag in venting orientation and for providing an overpressure in the package at least partly adjacently to internal venting means,

the method being novel in that

- ○ such a packaging bag is used in which at least one of the one or more sealed or glued seams is adapted to, at least for a pressure-keeping time of 1 second, only allow gas to essentially escape from the reshaped package at most in response to an external squeezing of the package.

[0014] The packing method can for example be implemented manually or with a mechanized packaging line. The provided granular product is necessarily suitable to be mixed with gas. Many such product types are known, generally known to have fine particle sizes, e.g. flour, cocoa powder, cement etc.. The package can for example be produced by packing the quantity of the granular product mixed with gas into a packaging bag in any suitable known way, e.g. manually or automatically, preferably in an FFS process (FFS is preferred to the traditional individual-valve-bag approach not only on a cost basis but also because state-of-the-art FFS is more adapted to provide low or zero overpressure in the bag at the

closing thereof). The packing generally includes a suitable closing of the bag after it is filled in order of preventing an essential loss of filling material, which closing can for example be closing a filling valve of a valve bag or, preferably, closing the open mouth of the bag with welding or adhering or sewing or with other methods. In the method the packaging bag comprises a flexible plastic (i.e. one or both of suitable synthetic and natural polymer) wall which comprises a vent for conducting gas from an inside of the bag into an air-channel and from the air-channel to an outside of the bag, which in itself is generally known to the skilled person familiar with plastic packaging bags provided with dust retaining, pocket-like, double-wall or multiwall vents. As it is also common, the vent is adapted to vent the bag if the bag is suitably oriented, i.e. if the bag is in a suitable venting orientation. Namely, as the skilled person knows, a vent incorporated in a bag wall will typically be adapted to suitably vent the bag if the bag is oriented in a manner in which the said bag wall is atop the bag, or is at least partly above the rest of the bag. The skilled person knows that the bag of the package is in a suitable venting orientation if the gas in it is adapted to be at least partly adjacent to an internal venting means of the vent. The air-channel is defined by air-channel-walls of the vent and is typically adapted to provide a path for gas, at least partly in and along the air-channel between the air-channel-walls. The vent comprises suitable internal venting means for conducting gas from inside the bag into the air-channel, the internal venting means possibly constituted for example, as taught in the prior art, by aperture(s) or perforation(s) in an air-channel-wall, for conducting air from the inner filling-space of the bag into the air-channel. The internal venting means can, alternatively, be constituted for example by suitably formed sealed or glued seam(s) having reduced degree of bonding sufficient to allow gas to enter from the inner filling-space of the bag into the air-channel, and thereby for example to escape from the package, in response to a suitable internal pressure. The vent is at least partly defined by means of one or more sealed or glued seams having in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to a suitable pressure, which is known, for example, from the aforementioned prior-art document US 20050281493A1. Such seam(s) can, as we said, constitute for example internal venting means and/or means for conducting gas from the air channel further towards the outside of the package. Preferably, this releasing of gas in response to a predetermined pressure can be achieved by reducing the bonding strength of the surface of the film, for example by means of a separation medium or Corona treatment. This is possible on one or more sides, over the entire surface or over a part of the surface only. Suitable separation media are all media preventing the plastic film from completely sealing or gluing, such as oils, greases, paints, lacquers, powdery solids, or coatings of other agents that produce the desired effect. A sealed seam includes for example a seam made with heat fusing or heat welding, e.g. hot-bar, high-frequency or ultrasonic welding. The term "the vent being at least partly defined" means that the vent can thus either be purely defined by sealed or glued seams or edges bordering, for example, the air-channel-walls, or the vent can, for example, be partly also defined by other means such as folded edges where adjacent air-channel-walls meet, or any other suitable means can be provided. When the package is being closed, it is known to for example be in a generally more or less vertical, suspended and/or propped-up position whether made by FFS or individual-bags processes. After the package is produced (in practice, for example, an open mouth bag is formed from a plastic FFS film-tube or - halftube, the mixture is filled into the bag and the top mouth of the bag is closed with a cross-welding), in the method the package is reshaped by at least partially rearranging its contents, which is a generally known step and usually means in practice, for example, that the package is dropped on a horizontal or somewhat inclined surface and is tossed to lie down towards a generally more horizontal position of the package, i.e. is laid down, its contents are horizontally more evenly rearranged and thereby the package is generally flattened. Due to the contents of the bag most often being at this time in a generally fluid state, the package is most often generally relatively easily reshapable. A turning of the package, for example from a more or less vertical into a more horizontal orientation, is known to generally stir up the contents usually rendering it even more fluidized, flowable, if possible. The term "the package is reshaped" means that the shape of the package is changed at least to some extent. The at least partial rearranging of the contents may include redistributing at least a portion of the contents by, for example, moving, within the bag, the granular product and the gas horizontally and vertically as well as separating or mixing the gas and solid materials. The reshaping of the package by an at least partial rearranging of its inner contents may for example involve moving the center of mass of the contents closer to a supporting surface supporting the package, which may, for example, also result in a reducing of a potential energy of the package. The reshaping is suitable to provide the bag in a suitable venting orientation, which means that the package is reshaped and thereby the bag is either maintained in or rendered into such an orientation as is suitable for a venting thereof. It typically means, for example, that the reshaping is suitable to provide the bag in an orientation at which the gas or fluid in the package is adapted to be at least partly adjacent to the entirety or a part of the internal venting means. Most commonly, for example, the bag wall panel, in which the vent is incorporated, is provided on the top of the package. The reshaping is suitable to provide an overpressure in the package at least partly adjacently to internal venting means, i.e. at least partly adjacently to the entirety or one or more parts of the internal venting means, which means that the package is reshaped and thereby such overpressure is either maintained or created. Suitably changing

the shape of the package (in practice usually rendering it closer to a brick-like shape), can be used to increase a pressure in the bag. The extent of this increase, in the absence of an essential loss of gas from the package, can depend for example on the extent to which the volume of the inner filling-space of the bag, available for the compressible gas contents of the bag, is reduced during the reshaping. Generally speaking, the more the bag is flattened by the reshaping, the more the reshaping is suitable for increasing the internal pressure. Thereafter an overpressure (as relative to an ambient air pressure) is maintained in the gas or fluid inside the bag at least partly adjacently to the internal venting means, whose actual pressure value will depend on several factors including, for example, the pressure originally provided in the package before the reshaping, the quantity and specific weight of the material of the granular product, the compacted apparent density value as a parameter of the provided granular product, the relative air content of the contained air-solid mixture, the size and shape (e.g. the proportions of the three dimensions) of the reshaped bag as well as of the bag before its reshaping, the surface weight of the flexible plastic wall, especially of the top bag wall panel, of the packaging bag etc..

[0015] According to the invention, in the reshaped package at least one of the said one or more sealed or glued seams has the said (reduced) degree of bonding sufficiently high and thereby the seam is adapted to at least partly withstand the said provided overpressure, at least for a pressure-keeping time of 1 second, by only allowing gas to essentially escape from the package at most in response to a suitable external squeezing of the package, notwithstanding that the bag of the package is provided in a venting orientation. It means that the built-in pressure-selective venting seam is formed in a manner that its bonding strength is relatively high, more exactly, is high enough to make the seam at least partly resist, for a certain period of time, the overpressure of the bag. In general, the minimal time interval of the at least partial resisting, here called pressure-keeping time, is usually implemented as a continuous uninterrupted time interval but it means accumulated time if the overpressure is, in the meantime, temporarily suspended for some reason, the reason possibly being for example a transient in the reshaping procedure or some effect originating from a separation-enhancing vibration etc.. The pressure-keeping time is a time interval which starts earliest when the package has been suitably reshaped to at least some extent, i.e., earliest when its contents have been rearranged to some extent and the bag of the package is in a venting orientation and there is suitable overpressure in the package. The term "at least partly resist" means that the said seam of the reduced strength is adapted to, at least for as long as corresponds to the aforementioned uninterrupted or accumulated time parameter value, only allow gas to essentially escape from the reshaped package at most in response to a suitable external squeezing of the package which means that it is adapted to either essentially retain the gas (if the package is kept free from an external squeezing, for example, is left lying on a table or conveyor, or the package is only exposed to a suitably weak external squeezing), or allow gas to essentially escape only if there is an external squeezing of a suitable extent exerted on the package. In other words, the seam of reduced strength is, at least during the specified time interval, strong enough to prevent any gas from essentially escaping from the reshaped and overpressurized package unless the package is suitably externally squeezed. In practice, as we observed, the resistance of the seam, to the overpressure, being a function of time is realistic. For example glued seams based on an (especially pressure sensitive) adhesive closing potentially get (under overpressure stress) weaker by time. As another example, cross-welded seams, created at the moment when the bag is closed i.e. immediately before the reshaping, potentially get stronger (due to a cooling and solidification) by time, especially in a fast FFS operation. This time-dependent sealing strength gains a special significance in our invention, as the settling of the dust in the bag and also possibly the providing of the overpressure in the bag are time-dependent processes. As we said we recognized, the best result can be achieved if the pressure-selective seam prevents any gas from escaping during the pressure-keeping time unless the package is compressed, squeezed from outside, which specification can practically be simply implemented, but which specification, however, could in practice be formally bypassed without essentially lessening its technical merits. Not withstanding our aforementioned recognition; if the seam allows gas to escape, within the pressure-keeping time without a suitable external squeezing, to such a small, unessential extent as does not result in essential quantities of dust being conducted into the air-channel then our advantage can still be provided. A greater, essential gas conduction, however, must be prevented according to our invention. Therefore the definition of the term "to essentially escape" is as follows: gas is allowed, at a moment, by one seam to essentially escape from the package if the momentary escaping rate, expressed for example in cm^3/sec, of the gas through that one seam would, if sustained, be sufficient to completely compact the package, as given at the moment, within 5 seconds counted from the moment. (In accordance with our recognition, in more preferred embodiments the latter definition value could be selected to be 8 seconds, more preferably 10 seconds, more preferably 15 seconds, 20 seconds, 25 seconds, even better 30 seconds.) The best solution, however, is, as we said, if the seam is practically impermeable to the overpressurized gas during the pressure-keeping time unless the package is externally suitably squeezed. The present invention provides the advantage that it makes the skilled person capable of selecting a time at which the gas is first conducted (or at least first essentially conducted) from the bag, by selecting a time when a suitable external squeezing is first applied to the bag. (The skilled person, depending on the

given circumstances, should select effective ways of squeezing, for example a combination of both vertical and horizontal compression, in order of sufficiently compacting the packages with respect to a possible lack of a later spontaneous venting in a later, stacked phase.) As we said, the more the skilled person decides to wait, the purer the released gas is. Since, as we said, the gas-solid separation, especially a vibration-enhanced separation, is fast during the aforementioned, early time period (pressure-keeping time) during which the gas is possibly retained, the air can become effectively purer during the pressure-keeping time. The resulting advantage of our method invention is that it helps to pack with a reduced quantity of residual powder contained in the vent of the bag and thereby helps to eliminate the drawbacks caused by the residual powder.

[0016] For practical reasons it is preferable if a reshaping of the package includes flattening and vibrating. Flattening here means making the package more flat-shaped than before.

[0017] For even purer gas to be provided in the top region of the filling-space of the bag, it is preferable, if the pressure-keeping time is a period of time of 1.5 seconds, more preferably 2 seconds, more preferably 2.5 seconds, more preferably 3 seconds, more preferably 3.5 seconds, more preferably 4 seconds, more preferably 4.5 seconds, more preferably 5 seconds, more preferably 10 seconds, more preferably 20 seconds, more preferably 30 seconds. The advantage thereof is that it helps to keep the air-channel even cleaner in the end. (The seam could of course keep the pressure also for a much longer time, but keeping the pressure without squeezing/deflating longer than for example 24 hours, as a theoretical optional upper limit in the definition of the pressure-keeping time, would not add much further practical advantage in our method.)

[0018] In order of possibly minimizing the overpressure in the reshaped package, and thereby possibly also keeping the limit pressure value, at which the weakened seam is meant to open up, relatively low, it is preferable if, in our method, in the produced package, prior to its reshaping, in at least a portion of an inner filling-space of the packaging bag at least temporarily a pressure, essentially equivalent to, or lower than, an ambient atmospheric pressure, is provided. This, as we said, is probably simpler to achieve with an FFS apparatus than with, for example, an air-assisted valve bag filler. The term "essentially equivalent" means that for example a pressure difference merely caused by a weight of loose bag walls or other bag parts, or any similar minor pressure difference, is to be neglected and in such cases the pressures are to be considered equivalent.

[0019] We arrived at an insight into the nature of why our basic problem, i.e., the particles being stuck within the air-channel, is more serious if the granular product contains markedly fine powder. Namely, within a particle size interval zero to 150 microns, the smaller the particles are, definitely the more significant the attracting effect of surface energies of the particles, and of adjacent solid surfaces, is. Therefore the really small particles are much more prone to stubbornly adhering to the inner surfaces of the air-channels making it more difficult to remove them before a recycling. In addition, the adhering effect of electrostatic attraction, very frequent with plastic film bags, also gets more significant with particles getting smaller. This is based on the fact that both the surface tension attraction force and the electrostatic attraction are essentially proportional to surface area and that the "surface area/weight" ratio of a particle directly depends on how small the particle is, and is a quite large value with tiny particles. Therefore our method provides a **more significant advantage** over prior art, if at least 1 mass percent, preferably at least 2, more preferably at least 3, even more preferably at least 5 mass percent of the granular product has a granule size below 150 microns, preferably 100 microns, more preferably 50 microns, even more preferably 25 microns, even more preferably 10 microns, even more preferably 5 microns. The granule size should preferably be greater than 0.05 microns, under which it is more difficult to suitably retain the dust.

[0020] As we said, our newly identified problem originates from stirred-up, airborne powder particles contents flowing into the air-channels during venting. After a mixing with air, some powder types settle from air quickly while others do not. Prior-art solutions did not set an objective to wait until the dust suitably settles, nor did they give good solutions for the waiting. Our said problem, and therewith also providing a good solution therefor, is especially difficult if the granular product is a slowly-settling material. We recognized that our problem to be solved, and therefore also the advantage of our solution, is especially significant with such granular products as are able to take up relatively much additional air and are also able to remain, for a time relatively long with respect to the duration of the filling process, in an aerated state, at rest. The more air is contained, and for the longer time, the higher the significance is. It is therefore preferable if the provided granular product is suitable to be mixed with air and thereby to be rendered into, and to remain, at rest, at least for 30 seconds, preferably at least for 45 seconds, more preferably at least 60 seconds, more preferably at least 90 seconds, more preferably at least 120 seconds, (preferably, however, at most 168 hours) in an aerated state in which an apparent density of the granular product is at most 98% (preferably at most 95%, more preferably at most 90%, more preferably at most 87%), (preferably, however, at least 15%) of an apparent density belonging to the granular product in a fully compacted state thereof, the latter meaning the apparent density that the granular product has when the granular product is in a fully compacted state. This specification means that during the specified time interval (e.g. 30 seconds), which the product (about 1 kg of the product) spends at rest, in an opentop, e.g. cube-shaped, vessel in normal atmospheric pressure (i.e. free of artificial over- and underpressure, squeezing etc.), the apparent density thereof is al-

lowed to increase but at the end of the specified time interval the apparent density must be at most the specified value (e.g. 98% of the compacted apparent density). Apparent density is known to be the density of a loose or compacted granular material determined by dividing actual mass by volume occupied by the material including the voids which are in the material. A granular product is considered by a skilled person to be in a fully compacted state if it, left at rest in normal atmospheric pressure, is not losing any air any longer, i.e., if its apparent density is already constant in time.

[0021] As we said, our problem to be solved (namely to also lessen the wear of the recycling extruder in a recycling of the material of the used bag), and thereby also our solution, is **more significant** if the granular product contains any one or more of cement, calcium oxide, calcium carbonate, calcium hydroxide, sand, mineral, stone, ore, metal and glass. Due to their very hard material combined with their usually very fine dust structure, the advantage of our method is **especially significant** if the granular product contains any one or more of cement, calcium oxide, calcium carbonate and calcium hydroxide. Cement is a very abrasive material. It is manufactured to be applied in hydraulic reactions therefore it necessarily has very fine granules. A product having very small granules makes, as we explained earlier, the advantage of our invention more significant, because of the increased surface tension effects. Due to a special combination of small particle size and an extremely abrasive character, cement and other granular products containing cement make the advantage provided by our method especially significant. Therefore it is **preferable** if at least 1 mass percent, preferably at least 2 mass percent, more preferably at least 3 mass percent of the granular product is cement. It can, for example, be Portland cement or any other kind of cement.

[0022] As we said, the technical prejudice prompts the skilled person to stack the packages as early as possible in order of reducing required time. As it is known, if the package spends a longer time, from reshaping to stacking, on a conveyor which is usually used for forwarding the packages in a pipeline from the filling/reshaping station to the stacking station, a longer conveyor and therewith more room will be needed. For an avoiding thereof, the technical prejudice will prompt the skilled person to stack, i.e. palletize, the packages as soon as they are deflated to such an extent at which they are already acceptably safely palletized. The said extent of deflation does not mean a final full extent of deflation in the prior art. Namely, in the case of packages prior to US 20050281493A1, the packages were typically stacked with a certain, minor, momentary air content therein which air later was spontaneously released from the bags through the (non-pressure-selective) vents at least in response to the weight of the loose bag walls, similarly to the example mentioned earlier, of the toy plastic boat deflating if provided with a fully open valve. With such bags, prior to US 20050281493A1, therefore it was not necessary to deflate, by direct squeezing, the packages more than that necessary for a palletizing. In our method, however, the pressure-selective weakened seam potentially stops a spontaneous deflation generated by, for example, a weight of loose bag wall parts, as soon as the internal pressure drops to a limit-pressure at which the vent potentially closes. That can make it necessary in our method, after providing a certain settling time free of essentially releasing gas in accordance with the invention, to suitably squeeze the package in order of expelling as much (possibly already relatively purified) gas as possible. This can mean that in our method, during an external squeezing, a top bag wall panel of the package must actually be pressed to and, along an essential area, abutted with, a top surface of the (preferably already relatively compacted) granular product contents, otherwise too much gas may finally remain in the package. This kind of full compression/contacting is not necessarily a must when packages prior to US 20050281493A1 are squeezed before stacking. On the other hand, with packages prior to US 20050281493A1 the spontaneous deflation, starting immediately when the package is first reshaped and pressurized, may conduct out much gas and early, and thereby the top bag wall panel may drop (spontaneously or by a little squeezing) onto the top surface of the granular matter at such an early time at which the latter is still essentially fluidized which causes fluidized matter (i.e. dusty air) to enter the air-channel. If, as with prior-art bags, the top bag wall panel, and therein some internal venting means (e.g. perforations) for conducting gas from inside the bag into the air-channel, is firmly pressed against a top surface of a relatively un-compacted, fluidized granular material, a risk of dust getting from the fluidized top surface of the granular material into the air-channel arises, which is bad in respect of our objective. Our method, however, makes the skilled person capable of waiting and selecting a time, for this compression, at which the granular contents are already sufficiently compacted to prevent too much of the granular contents from getting into the air-channel. Therefore the advantage provided by our invention is **especially significant** if, in the method, after a reshaping of the package a settling time, which is a period of time of at least 1 second, is provided and after an end of the settling time the package is externally squeezed by pressing and abutting at least a part or parts, of a top bag wall panel at least partly comprising the vent, to a top surface of the granular product contents. The settling time is a time interval which starts earliest when the produced package has been suitably reshaped to at least some extent, i.e., earliest when its contents have been rearranged to some extent and the bag of the package is in a suitable venting orientation and there is suitable overpressure in the package. After the settling time the top bag wall panel is either entirely contacted with the level, the top, of the granular matter or only one or more parts of the top bag wall panel are pressed thereto. The top bag wall panel is specified to at least partly comprise the vent. This is realistic since

the skilled person will typically select, as the place of the vent, the bag wall panel designed to finally become a top bag wall panel under which the gas, separated from the solids, is collected in a form of a bubble. The advantage of this method embodiment is, that due to the feature of possibly waiting for a period of time before we start to vent, internal venting means for conducting gas from inside the bag into the air-channel (e.g. perforations), possibly integrated into the top bag wall panel, can be pressed to and abutted on the top surface of the granular product contents with lower risks of polluting the air-channel because at the time of them being first abutted the said surface can already be relatively compacted. For even purer gas to be provided in the top region of the filling-space of the bag, it is preferable, if the settling time is a period of time of at least 1.5 seconds, more preferably at least 2 seconds, more preferably at least 2.5 seconds, more preferably at least 3 seconds, more preferably at least 3.5 seconds, more preferably at least 4 seconds, more preferably at least 4.5 seconds, more preferably at least 5 seconds, more preferably at least 10 seconds, more preferably at least 20 seconds, more preferably at least 30 seconds. The advantage thereof is that it helps to keep the air-channel even cleaner in the end. (The settling of the powder could of course be waited for (before essentially squeezing) also for a much longer time, but waiting without essentially squeezing/deflating longer than for example 24 hours, as a theoretical optional upper limit in the definition of the settling time, would not add much further practical advantage in our method.) In respect of our objective it is **more preferable** if, in the method, during the settling time the at least one sealed or glued seam is prevented from allowing gas to essentially escape from the package. In implementing this preferred embodiment, the skilled person should use a packaging bag in which the at least one sealed or glued seam is adapted to sufficiently withstand the overpressure of the reshaped package for a sufficiently long time in accordance with the essence of our method invention and, also, during the settling time the package should be kept free from any external squeezing of such extent as would cause any gas to be essentially expelled through the at least one sealed or glued seam. It means that during the settling time the package is either kept free from external squeezing or is at most exposed to such external squeezing as is insufficient to essentially expel gas through the at least one sealed or glued seam. It is even **more preferable** if, in the method, during the settling time the at least one sealed or glued seam is prevented from allowing gas to escape from the package. It is even **more preferable** if, in the method, during the settling time gas is prevented from escaping from the package. In order of avoiding the risk of too much of residual surplus air eventually remaining in the stacked sacks in the absence of an uncontrolled venting, it is advantageous if as much air is expelled with the squeezing as possible, therefore it is **preferable**, if, in the method, the said external squeezing also includes compressing of opposed package sides. (In this terminology, the package rests on its bottom, and it has a top /opposing the bottom/ and it further has package sides.) That can be done, for example, with suitable pressing conveyors placed on the two sides of a path of the package. The compressing of the individual package sides and also that of the top bag wall panel can all take place synchronously or at different moments.

[0023] It is **preferable** if, in our method, the packaging bag is any of the novel packaging containers described below.

[0024] As we said, it is also our objective to provide a plastic packaging container that has improved dust retaining venting means suitable to help to vent the bag with a reduced quantity of accumulated residual powder. The following has lead us to our product invention. As we said in the previous paragraphs, in a preferable embodiment of our method, at least a part or parts of a top bag wall panel at least partly comprising the vent are pressed to, and abutted upon, a top surface of the granular product contents, the latter being in a relatively compacted state by the time of this contacting. As we said our general objective is preventing dusty air from entering the air-channel. We observed that in the settled, generally compacted granular product the most compacted, hardest parts are at the bottom of the package and the top surface of the granular product, the one to be contacted with the top bag wall panel comprising the vent, is the least compacted, in other words the most fluidized, softest or most aerated part of the bulk of the granular product. At such a state, the gas bubble filling the top portion of the inner space of the bag, above the granular product, can be a definitely pure gas, very suitable for venting. A first phase of a squeezing venting procedure can be accomplished without problems by conducting much of the aforementioned pure gas out of the package. Then, in a second phase of the squeezing venting procedure, if a portion of the top bag wall panel is pressed to and abutted with the top surface of the granular product when the latter is still somewhat aerated, the dust from the top of the granular product can enter into the perforations of the interior wall of the air-channel, constituting the internal venting means for conducting gas from inside the bag into the air-channel as in accordance with the teaching of US 20050281493A1. It causes, for example, the problem, especially with the most critical granular products discussed hereinabove, that one may have to wait too long before pressing and abutting with a desired success. It is our objective to provide a solution by which it is made possible to even further decrease, especially in the aforementioned second phase of the squeezing venting procedure, the quantity of dust entering the air-channel even if a top surface layer of the granular product is still in a somewhat aerated, un-compacted state at the time at which the top bag wall panel (at least partly comprising the vent) is pressed to and abutted with the top surface of the granular product contents.

[0025] In order to make our recognition, we arrived at

an insight into the nature of the problem of the dust entering the perforations (see FIG. 11). Namely, when the top bag wall panel is abutted, along an essential surface area, on the top surface of the granular product contents, at least portions of the interior wall of the air-channel, taught by US 20050281493A1, are pressed into an essentially full-surface abutment with the top surface of the granular product contents. It results in that each perforated opening in those abutted portions of the interior wall are more or less isolated from the gas bubble being above the said top surface by which these openings can not any longer conduct gas directly from the region of the inner filling-space of the bag in which the (relatively pure) gas is. As the pressing and abutting procedure proceeds the further squeezing generates an overpressure that will be released through the said isolated openings into the air-channel. The result is that contents, comprising a mixture of granular product and gas, enter the openings from under the top surface of the granular product. This is possible because the top layer of the granular product is somewhat aerated, fluidized, flowable, conductive to gas as we said. As we observed, in this state of the granular product the granular product is, thanks to an earlier waiting for a suitably long time, typically compacted and hard enough to provide a suitable solid and definite abutting surface which prevents the bag wall portions from being too much immersed into the granular product, but is still aerated enough to conduct fluidized mixture (i.e. dusty gas) from the top layer of the granular product into the openings of the interior wall of the vent. The flow direction of this conducting is, in the prior art, generally normal to the top surface of the granular product (corresponding to the orientation of the openings, e.g. perforations, penetrating through the interior air-channel-wall). This special flow direction contributes to the fact that the gas can not be conducted to the openings, isolated from the gas bubble of the package, other than through the somewhat aerated layer of the bulk of the granular product. We recognized that we can solve this problem if either we eliminate the openings that penetrate through the interior air-channel-wall and select alternative, improved internal venting means for conducting gas from inside the container into the air-channel, or we eliminate the general flat construction of the vent in which it is arranged in an "interior wall-exterior wall" combination as taught by US 20050281493A1, which, as we could see, is inherently available for a problematic full surface abutment with the top surface of the granular product.

[0026] We believe that this recognition is non-obvious, as nothing in the prior art leads the skilled person away, in these respects, from the definite teachings of US 20050281493A1. Namely, as concerning our aforementioned second improvement approach to eliminate the general flat construction of the vent: all prior-art air-channel-vented plastic heavy duty shipping bags known to have been successfully implemented in the practice of industrial packaging of bulk solids are arranged in the usual flat, interior wall-exterior wall combination, as also taught by US 20050281493A1, and there is nothing in US 20050281493A1 or in the prior art as a whole that would make the skilled person arrive at selecting a different (and probably technically more difficult) approach for the air-channel structure instead of the usual flat, interior wall-exterior wall structure. Now as concerning our aforementioned first improvement approach comprising a vent based on the known flat, interior wall-exterior wall combination but with alternative internal venting means, it is known that it is possible to apply, as internal venting means, interruptions in the welding seams joining the air-channel-walls together and defining the area of the air-channel. This approach, however, is known to be used with air-assisted filling (typically for example: cement-filling with pneumatic filling systems into valve bags) where the very much transportation air, used for conveying the filling material, must simultaneously be vented, through the weld-interruption, during the filling, in order to prevent the bag from bursting. This approach provides high venting capacity but is not believed to be attractive for the skilled person, relying on the technical prejudice, faced with the problem of packing, preferably FFS-packing, fine powders into vented plastic bags simultaneously preventing fine powder from being released from the bag and especially from the internal filling-space of the bag, because such un-welded interruptions are known to be practically impossible to be implemented to constitute such small openings as the fine pin-perforations and as are necessary for solving this problem successfully in the prior-art approach simultaneously endeavoring to vent as early as possible. We are supporting this as follows. Prior art document US 3,937,395 provides a plastic bag whose vent comprises overlapping panels forming an air-channel having interior and exterior walls. The openings, for conducting the air into and out of the air-channel, are taught to possibly be interruptions in the seams joining the panels together. In the document the purpose of the vent is to at least allow the escape, from the otherwise air-impermeable bag, of the air that carries the powder into the bag, so that filling is not interrupted. The document does not mention an objective of effectively retaining the dust. On the other hand, patent document US 4,743,123 states that plastic bags comprising perforations formed by the action of needles present the disadvantage that needle perforations are generally large in diameter, which means that, particularly during packaging loosely poured, particularly very fine materials such as cocoa and lime, particles are able to escape through the perforations. The document provides a plastic bag for packing loosely poured material comprising venting perforations having a size of 50 microns to 100 microns in the bag foil wall. Patent document US20080273820A1 provides a perforated film, comprising perforations of a size of at most 100 microns in order of an acceptably low powder leakage. Summing it up, it is known, from the prior art, to the skilled person that for retaining fine powders in vented bags, definitely fine perforation is needed, and that it is very difficult, in fact practically impossible

to achieve an acceptable result by trying to retain fine particles from a fluid with interrupted seams. In addition, our closest prior-art document US 20050281493A1 suggests the skilled person to retain, as much as possible, fine dust from entering through the internal venting means into the air-channel. Namely, the document says that after some venting, the interior and exterior films are arranged tightly on top of each other in the weakened seam, being fixed in this position by adhesive forces. Also, the document teaches that the special weakened seam, acting as external venting means for conducting gas from the air-channel to an outside of the bag, is a very good filter, and even the escape of very fine particles is practically impossible through the weakened seam, which can be attributed to the fact that the adhesive forces acting between the films, which are only in part firmly connected to each other, produce a certain degree of adhesion even without a securely sealed or glued connection and thus the venting seam is partially gas permeable. The document teaches that in its most preferred embodiment the width of the weakened seam is very small (see Fig. 3. of US 20050281493A1). The document further says that though it is possible to provide, as internal venting means, slits or other openings in the interior wall permitting gas penetration, preferably the openings in the interior wall are perforations made by needling. The document further says that particularly where very fine product is concerned, the internal openings are preferably arranged such that the distance from the openings to the seam, allowing the gas to escape, is as long as possible, explicitly teaching the skilled person to take measures to keep fine dust from reaching the weakened seam. This also means a (not surprising) teaching for the skilled person that fine dust can, from the fluid, enter the air-channel even with fine perforations, like needle perforations, applied. The skilled person, as we earlier said, is generally prompted by the technical prejudice to avoid overloading the dust retaining air-channels with too much dust because that can clog the vent from breathing. In the US 20050281493A1 document the weakened exit seam of the air-channel is capable of retaining all small particles but it, unlike fibrous filters, does not actually have a filtering volume capable of accumulating the filtered-out dust in its matrix without harm. It directly stops the dust at its entrance cross section area, and in addition, it has an extremely small effective cross section (width as well as height). This filter seam, taught in US 20050281493A1 to be partially gas permeable, is apparently easy to clog, and evidently needs attention from the skilled person in order of preventing too much dust from entering into the air-channel. It is known from the prior art, and also the document provides such hints, that if the internal perforations in the bag of US 20050281493A1 are fine but not fine enough then much powder enters from the fluid contents into the air-channel which involves a risk of clogging the exit seam. The skilled person therefore will be prompted to endeavor to select internal venting means comprising as fine perforations as possible. In our present inventive concept, common in this whole description, however, the preventing of the air-channel from getting loaded with dust is not based on filtering the fluid at the internal venting means but is, instead, based on providing, through the suitable use of suitably formed vents having weakened seams, a relatively pure (i.e. relatively dust-free) gas for conducting into the air-channel as a result of a previous separating procedure in which the solid and gas components are at least partly separated.

[0027] The essence of our product invention is a **packaging container**, comprising a flexible plastic wall which comprises one or more vents, the one or more vents

- o adapted to conduct gas from an inside of the container into an air-channel and from the air-channel to an outside of the container,
- o having air-channel-walls defining the air-channel,
- o comprising internal venting means for conducting gas from inside the container into the air-channel,
- o at least partly defined by means of at least one sealed or glued seam having in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to a suitable pressure,

the packaging container being novel in that in one or more of the vents,

- o if the vent is formed to comprise a region of the flexible plastic wall having an interior wall and an exterior wall then the vent is free of openings
  - ■ penetrating through an interior wall
  - ■ for conducting gas from inside the container into a region between interior and exterior walls, and
- ○ otherwise
  - ■ either the air-channel-walls of the vent are free of openings constituting internal venting means
  - ■ or at least one air-channel-wall of the vent comprises one or more openings constituting internal venting means.

[0028] The terms used in the invention are interpreted as follows. Packaging containers according to the invention are, among others, FFS tubes, center-folded FFS films (so-called half-tubes), block bags, open-mouth gusseted bags and flat sacks, valve sacks (glued and heat-sealed), hexagonal bottom sacks, automatic machine (flat) films, etc.. The flexible plastic (i.e. synthetic or natural polymer) wall can be single-layer or multiple-layer (for example coextruded or laminated) or a combination of both. The bag wall comprises a vent or more vents, which can either be the usual flat vent having a generally flat air-channel (preferably with suitable spacers therein) defined by interior and exterior walls (most typically provided by overlapping bag wall panel edges) or any other,

e.g. generally non-flat, structure comprised by the bag wall and adapted to suitably conduct gas from the inside of the container into an air-channel and from the air-channel to the outside of the container according to the invention. Accordingly, the air-channel-walls can be of a general structure similar to, for example, that of US 20050281493A1 (without regard now to openings therein) or can be different, as long as they define an air-channel adapted to provide a path for gas, at least partly, in and along the air-channel between the air-channel-walls. The vent comprises suitable internal venting means for conducting gas from inside the bag into the air-channel. In general, internal venting means can possibly be constituted for example, as taught in the prior art, by aperture (s) or perforation(s) in an air-channel-wall, for conducting air from the inner filling-space of the bag into the air-channel. Internal venting means can, for further example, be constituted by suitably formed sealed or glued seam (s) having in at least a partial region a reduced degree of bonding sufficient to allow gas to enter from the inner filling-space of the bag into the air-channel in response to a suitable internal pressure, thereby allowing gas to escape. As concerning external venting means for conducting gas from the air-channel to the outside of the bag, it is known, for example, from the aforementioned prior-art document US 20050281493A1, that the vent can be at least partly defined by means of at least one sealed or glued seam having in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to a suitable pressure. The skilled person could form the aforementioned sealed or glued seam (comprising, for example, one or more of corona treatment, lacquer layer, adhesive coating etc.) to have a (reduced) degree of bonding corresponding to any positive value in the range of 0 to 100 percent bonding strength as compared to the bonding strength achievable without the said reduction. The prior-art prejudice prompts the skilled person to select a value definitely close to zero, as we explained earlier herein. Based on our present general inventive concept, however, now the skilled person would select relatively higher values, as depending on the selection of the skilled person in accordance with his/her practical application objective, thus depending, for example in a given packing method, for example on the size and shape of the bag, on the surface weight of the wall of the bag, on the quantity and specific weight of solid contents packed in the bag, on initial gas contents provided in the bag during packing etc. A sealed seam includes for example a seam made with heat fusing or heat welding, e.g. high frequency or ultrasonic welding. The vent can thus either be purely defined by sealed or glued seams or edges bordering the air-channel-walls, or the vent can, for example, be partly also defined by other means such as folded edges in which adjacent air-channel-walls meet, or any other suitable means can be provided. The novelty of the invention, is an improvement in the vent which is essentially related to the specification of the internal venting means for conducting gas from inside the container into the air-channel. Namely, if, on the one hand, the vent is formed to comprise a region of the flexible plastic wall having an interior wall and an exterior wall then the vent is free of such openings which openings penetrate through an interior wall for conducting gas from inside the container into the region between interior and exterior walls. In other words, if the vent is formed to comprise a region of the flexible plastic wall having an interior wall and an exterior wall then the vent at most comprises openings other than openings penetrating through an interior wall for conducting gas from inside the container into the region between interior and exterior walls. In this case the internal venting means (for conducting gas from inside the container into the air-channel) can comprise, for example, one or more openings being between an interior wall and an exterior wall, preferably provided in the form of interruptions in the welding (or glue-) seams joining the interior and exterior walls together. This can, for example in a packing process, mean that the gas enters into the flat shaped air-channel through its side edge and in a direction parallel with the bag wall and with a plane of the flat region and with the top surface of the granular product, which has the advantage that air, going through the interruption opening, can be conducted above the top surface of the granular product and is not forced to penetrate the granular product. Here the interior wall can contribute to providing a spacer providing a free space for the gas-conducting, corresponding to a sum of the wall thickness of the interior wall and the height of possible spacer means in the opening, thanks to the top surface of the granular product possibly rendered, in a suitable packing process, solid enough to prevent the interior wall from essentially immersing into it. Another solution can be found among the examples later herein. And if, on the other hand, the vent is formed otherwise, then the skilled person is free to select internal venting means comprised of openings in any of the air-channel-walls of the vent as well as to select a solution in which any of the air-channel-walls is free of openings penetrating therethrough and constituting internal venting means. In this respect, the construction of one air-channel-wall is independent from that of another air-channel-wall, thus it is possible to form one or more air-channel-walls with openings penetrating therethrough and constituting internal venting means and, at the same time, to form one or more other air-channel-walls without openings penetrating therethrough, constituting internal venting means. Here any suitable vent structure can be selected other than the usual structure, more exactly other than a vent comprising a region of the flexible plastic wall having an interior wall and an exterior wall. A simple solution can be, for example, forming an air-channel sharply projecting into the inner filling-space of the bag providing the projecting air-channel with a positive projection height, in which structure a flat envelope of the air-channel is essentially perpendicular to the bag wall to which it belongs, rather than parallel therewith (which is the case with the usual

interior wall/exterior wall approach). A projecting end edge of the air-channel can serve, during a squeezing in a packing process, as an abutting point, abutting on the top surface of the granular product and thus providing spacer means providing a space between the bag wall and the top surface of the granular product in which space the air can be conducted to the air-channel. The skilled person will readily select air-channel-wall parameters (e.g. film base material and dimensions) suitable for this spacing. The two air-channel-walls of this possible vent embodiment could be essentially symmetrical and both could be essentially normal to the bag wall to which they belong. They are thus neither interior nor exterior walls but they are side walls instead, which preferably comprise penetrating perforations to receive the aforementioned gas flow, arriving, in a packing process, parallel with the top surface of the granular product. One or both of these air-channel-walls, however can as well be free of openings, in which case the internal venting means can comprise openings, for example, in the edge which borders the air-channel-walls, being formed, for example, as the aforementioned seam interruptions, as is described in the example later herein. In accordance with all that has been described hereinabove in connection with our method inventions, the advantage of the packaging container invention is that it, during an external squeezing of the package in a packing process, helps to conduct purified gas from the upper gas bubble into the air-channel directly, i.e. without conducting the said gas through a top layer of the granular product, by which it is suitable to help to vent the bag with a reduced quantity of accumulated residual powder. The advantage of the aforedescribed invention is that it achieves our objective to provide a plastic packaging container that has improved dust retaining venting means suitable to help to vent the bag with a reduced quantity of accumulated residual powder.

[0029] If, however, we aim to prevent dusty air from entering the air-channel and the container has more than one of the above-specified vents then each of them should preferably be improved as specified herein. As we could see, in embodiments advantageous in a manufacturing respect and in respect of operation in our methods, the packaging container is preferably such as its internal venting means comprise one or more openings in a seam defining a vent. In this sense a seam defining a vent means such a seam as takes part in defining one or more of the said one or more vents. The packaging container is more preferably such as its internal venting means comprise at least one opening selected from a perforation in a folded seam, an interruption of a welding in a welded seam and an interruption of a gluing in a glued seam. The said seam interruptions can be relatively short, for example having a length similar to, or not too much greater than, an air-channel-wall thickness, but the seam interruptions can theoretically be rather long as well, even potentially occupying the majority or even almost the whole of a total seam length. As the seam interruptions can possibly conduct more dust into the air-channel than a fine perforation through the interior air-channel-wall, the packaging container is preferably such as it has fibrous filter in at least a part or parts of an air-channel. Further it is **preferable** if at least a part or parts of the fibrous filter is contained in a sealed or glued seam having in at least a partial region the reduced degree of bonding. This has the advantage that the fibrous filter can take part in forming the reduced degree of bonding. It is **even more preferable** if the at least one sealed or glued seam, of the reduced degree of bonding, is a welded seam comprising the fibrous filter and flexible walls fixed to each other at least partly, and a material of at least one of the flexible walls fixed in the welded seam is incompatible for welding with a material of the fibrous filter fixed in the welded seam to an extent sufficient to provide a reduced degree of bonding. This way a reduced degree of bonding can be provided, for example with providing different polyolefins for the welding in the seam. N.B.: the material of the fibrous filter fixed in the seam can be in a state in which its fibers are partly or completely fused and distorted. As we could see, in several cases the air-channel-wall can provide spacer means whose space size depends on a wall thickness of the air-channel-wall. Therefore (however a thick air-channel-wall is not necessary for the air-channel to work well) the packaging container is **more preferably** such as it has an air-channel-wall having at least partly a thickness of at least 70 microns (optionally limited to at most be, for example, 5000 microns). Also, as we could see, in any of these cases, any spacer means provided in the openings also help to keep the top bag wall, in a packing process, farther from the top of the granular solid, thus providing a space not only in the opening but also above the top surface of the granular solid. Therefore the packaging container is **more preferably** such as it has spacer means provided in at least one of the one or more openings in a seam defining a vent. For a more reliable spacing above the top surface of the granular product, the said spacer means **preferably** comprise one or both of a nonwoven and at least one projection of a projection height of at least 50 microns (optionally limited to at most be, for example, 5000 microns).

[0030] As we said, it is also our objective to provide systems comprising a novel plastic packaging bag, which has improved dust retaining venting means suitable to help to vent the bag with a reduced quantity of accumulated residual powder, and granular contents packed therein. Our system invention is also based on our present general inventive concept, common in this whole description, namely the preventing of the air-channel from getting loaded with dust is not based on filtering the fluid at the internal venting means but is, instead, based on adapting the system to provide, through the suitably formed vents having weakened seams, a relatively dust-free gas, at least partly separated from the solids, for conducting into the air-channel.

[0031] As we said earlier, at forming the aforemen-

tioned sealed or glued weakened seam (comprising, for example, one or more of corona treatment, lacquer layer, adhesive coating etc.) to have a (reduced) degree of bonding corresponding to a positive value in the range of 0 to 100 percent bonding strength, as compared to the bonding strength achievable without the said reduction, the skilled person is prompted by prior-art prejudice to select a value definitely close to zero. In accordance with our present inventive concept, however, now the skilled person would select relatively higher values. As we recognized, a bag containing an air-solid mixture and provided with a vent having a pressure selective weakened seam can more easily be handled in a way suitable for our objectives if the pressure selective weakened seam is strong enough, i.e. is adapted, to suitably safely withstand such overpressures (of the package) as may arise in the bag while the package is handled, before a final squeezing thereof (for a final venting), in the usual way in the industry, including for example filling, compacting, then closing, then dropping, tumbling, tossing, laying down, conveying, flattening and vibrating. The actually arising overpressures depend on many circumstances, mentioned earlier hereinabove. In our general recognition, pressure values possibly defining, in any combination, the two ends of the interval from which the predetermined limit pressure could possibly be selected in case of need, depending on the circumstances, like filling weight, bag dimensions and bag wall thickness, could, for example, include 0.0000001 bars, 0.000001 bars, 0.00001 bars, 0.0001 bars, 0.001 bars, 0.01 bars, 0.1 bars, 1.0 bar, and 10 bars.

[0032] The essence of our system invention is a **system** comprising a packaging bag containing a quantity of a granular product mixed with a gas, the packaging bag comprising a flexible plastic wall which comprises a vent, the vent

- o adapted to conduct the gas from an inside of the packaging bag into an air-channel and from the air-channel to an outside of the packaging bag,
- o having air-channel-walls defining the air-channel, and
- o at least partly defined by a sealed or glued seam having in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to an overpressure in the packaging bag exceeding a predetermined limit,

the system being novel in that

the predetermined limit is selected from the interval between 0.0001 bars and 10 bars.

[0033] Most of the terms used were already defined. The packaging bag may be fully filled with the mixture but it is also possible that the packaging bag also contains other contents than the mixture, for example separated solids or gas. The advantage of the system is that it, due to the reduced bonding strength of its pressure-selective vent being high enough, is easier to be processed into a compacted, vented package with a reduced degree of residual powder contamination.

[0034] In respect of our objective it is **preferable** if the predetermined limit is selected from the interval between 0.001 bars and 10 bars, **more preferably** from the interval between 0.01 bars and 10 bars, even **more preferably** from the interval between 0.1 bars and 10 bars. Mainly in case of filling weights not exceeding the most common industrial filling weights it is preferable if in any of the aforementioned intervals the upper limit of the interval is 1 bar rather than 10 bars.

[0035] Our system provides a **more significant advantage** over prior art, if at least 1 mass percent, preferably at least 2, more preferably at least 3, even more preferably at least 5 mass percent of the granular product has a granule size below 150 microns, preferably 100 microns, more preferably 50 microns, even more preferably 25 microns, even more preferably 10 microns, even more preferably 5 microns. The granule size should preferably be greater than 0.05 microns, under which it is more difficult to suitably retain the dust.

[0036] The more air is mixed with the granular product in the packaging bag, the higher the significance and benefit of our invention is. It is therefore **preferable** if at least some of the granular product, mixed with the gas, is in an aerated state in which an apparent density of the granular product is at most 98% (preferably at most 95%, more preferably at most 90%, more preferably at most 87%), (preferably, however, at least 15%) of an apparent density belonging to the granular product in a fully compacted state thereof, the latter meaning the apparent density that the granular product has when the granular product is in a fully compacted state.

[0037] Analogously to our earlier results, our solution is **more significant** if the granular product contains any one or more of cement, calcium oxide, calcium carbonate, calcium hydroxide, sand, mineral, stone, ore, metal and glass, **preferably** any one or more of cement, calcium oxide, calcium carbonate and calcium hydroxide. It is **preferable** if at least 1 mass percent, preferably at least 2 mass percent, more preferably at least 3 mass percent of the granular product is cement. It can, for example, be Portland cement or any other kind of cement.

[0038] For a better separation of the contents it is **preferable** if the filling mouth of the packaging bag is closed. This includes closed by any possible closing means, generally in order of preventing an essential loss of filling material, which can for example be a closed filling valve of a valve bag or, preferably, the top mouth of the bag being closed by any one or more of welding, adhering and sewing or with other methods. It is **preferable** if the packaging bag is a packaging container according to any of the embodiments of our product invention.

[0039] All publications, patent applications, patents mentioned herein are incorporated by reference in their entirety. In case of conflict, the present specification, including definitions, will control.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040]

FIG. 1a. is a side view of an open-mouth flat bag with two vents.
FIG. 1b. is cross section "B-B" of a vent of the bag of FIG. 1a.
FIG. 1c. is cross section "C-C" of a vent of the bag of FIG. 1a.
FIG. 1d. is cross section "D-D" of the bag of FIG. 1a.
FIG. 1e. is cross section "E-E" of the bag of FIG. 1a. after a cross-welding of its mouth
FIG. 2a. is a side view of an endless tube, for FFS packaging, with a vent.
FIG. 2b. is cross section "B-B" of the vent of the tube of FIG. 2a.
FIG. 2c. is cross section "C-C" of the vent of the tube of FIG. 2a.
FIG. 2d. is cross section "D-D" of the vent of the tube of FIG. 2a.
FIG. 3a. is a side view of an open-mouth flat bag with two vents.
FIG. 3b. is cross section "B-B" of a vent of the bag of FIG. 3a.
FIG. 3c. is cross section "C-C" of a vent of the bag of FIG. 3a.
FIG. 3d. is cross section "D-D" of a vent of the bag of FIG. 3a.
FIG. 3e. is cross section "E-E" of the bag of FIG. 3a.
FIG. 4a. is a perspective view of a section of an endless tube, for FFS packaging, with a vent.
FIG. 4b. is a side view of a section of the endless tube of FIG. 4a, with the vent.
FIG. 4c. is cross section "C-C" of the vent of the endless tube of FIG. 4a.
FIG. 4d. is cross section "D-D" of the vent of the endless tube of FIG. 4a.
FIG. 4e. is cross section "E-E" of the vent of the endless tube of FIG. 4a.
FIG. 5a. is a perspective view of a section of an endless tube, for FFS packaging, with a vent.
FIG. 5b. is a side view of a section of the endless tube of FIG. 5a, with the vent.
FIG. 5c. is cross section "C-C" of the vent of the endless tube of FIG. 5a.
FIG. 5d. is cross section "D-D" of the vent of the endless tube of FIG. 5a.
FIG. 5e. is cross section "E-E" of the vent of the endless tube of FIG. 5a., also showing welded seam detail (32, 38) behind the section plane.
FIG's. 6a-h. illustrate the phases of a packing process in vertical section.
FIG. 7a. is the vertical section of a package being squeezed by a squeezing-conveyor.
FIG. 7b. is the magnified portion "B" of FIG. 7a as in accordance with Example 6.
FIG. 8. is the magnified portion "B" of FIG. 7a as in accordance with Example 7.
FIG. 9. is the magnified portion "B" of FIG. 7a as in accordance with Example 8, not showing welded seam details behind the section plane, for easier reading.
FIG. 10a. is the vertical section of a prior-art package as in accordance with Comparative Example 9.
FIG. 10b. is the magnified portion "B" of FIG. 10a.
FIG. 11 a. is the vertical section of a prior-art package as in accordance with Comparative Example 10.
FIG. 11b. is the magnified portion "B" of FIG. 11a.
FIG. 12a. is a side view of a closed flat bag FFS tube section with one vent.
FIG. 12b. is cross section "B-B" of the vent of the bag of FIG. 12a.
FIG. 12c. is cross section "C-C" of the vent of the bag of FIG. 12a.
FIG. 12d. is cross section "D-D" of the bag of FIG. 12a.

EXAMPLES

Example 1: a packaging container

[0041] Reference is made to the figures, especially to FIG. **1a** to 1e. This example packaging container is an open-mouth flat bag **1.** It comprises two opposed, 150-micron thick coextruded polyethylene bag walls **2, a** top open mouth **3** and a cross welded bottom **4.** One of the bag walls **2** comprises two vents **5,** each adapted to conduct air from inside of the bag **1,** from its filling space **15,** into an air-channel **6** and from the air-channel **6** to the outside **7** of the bag **1.** In both vents **5** uniformly, the construction of the vent **5** is such as the vent 5 has two, generally parallel air-channel-walls between which the vent 5 has an air-channel **6** adapted to provide a path for air in and along the air-channel **6** between the air-channel-walls. One of the air-channel-walls is constituted by the bag wall **2** and the other air-channel-wall is a 100-micron thick polyethylene film tape, connecting the bottom **4** edge **14** and the open mouth **3** and fixed to the inner surface **8** of the bag wall **2** with sealed seams **9.** The air-channel **6** is defined by two side seams **9** (being welded seams) parallel with the film tape and generally connecting the bottom **4** edge **14** and the open mouth **3** and the air-channel **6** is further defined by a pressure-sensitively adhered cross-seam **9** in the bottom **4** edge **14** and further by the open mouth **3.** (In a later use, the open mouth 3 is adapted to be closed with a cross welding which will complete the defining of the air-channel 6 by closing the other end thereof.) The pressure sensitively adhered cross-seam 9 (see FIG. 1d) of the air-channel 6, in the bottom **4** edge **14,** constitutes pressure-selective seam portion **16** as it has a reduced degree of bonding sufficient, in a practical application of the bag **1,** to allow gas **29** to escape in response to a suitable predetermined pressure provided in the bag **1.** The skilled person can select a bonding strength and durability in accordance

with the given application, for example using the teaching of US 20050281493A1. The cross-seam **9** at the bottom **4** provides in the vent **5** external venting means for conducting air from the air-channel **6** to the outside **7** of the bag 1 in response to the aforementioned pressure provided. On the other hand, in one of the two welded side seams **9,** partly defining the air-channel **6,** there are interruptions provided in the welding of the welded seam **9**. The interruptions provide internal venting means **10,** and provide openings for directly conducting air from inside the bag 1 into the air-channel **6.** Thus the structure of both of the vents **5** is such as the vent **5** is formed to comprise a region of the flexible plastic bag **1** wall **2** having a 100-micron thick interior wall **11** and a 150-micron thick exterior wall **12.** The vent **5** is free of openings penetrating through the interior wall **11,** because, as we said, the internal venting means **10** are provided as interruptions in the welding of the welded seam **9,** between the interior wall **11** and exterior wall **12.** There is a fibrous filter **13** provided in the form of a spunbonded nonwoven sheet, at least partly containing polypropylene and of about 17 g/m^2 surface weight, placed in between the air-channel-walls, i.e. between the interior wall **11** and exterior wall **12,** simultaneously being spacer means and fibrous filter **13.** As at the manufacturing of the tube **44** from which the bag **1** was made the nonwoven sheet or tape was endlessly applied into the tube **44,** the fibrous filter **13** is contained in the seam **9** having the reduced degree of bonding, at the bottom **4** of the bag 1. When the bag **1** is later closed by a cross-welding of its mouth **3,** the cross-welding will produce (see FIG. 1e) a welded seam **9,** partly defining the vent **5,** in which the fibrous filter **13** will also be contained, in which, as the skilled person knows, a partial, predeterminable incompatibility of the materials of the nonwoven and of the flexible walls **2** (one of them being the original 100-micron thick air-channel-wall) in the seam **9** can be utilized in order of creating also in the bag **1** mouth **3** a seam **9** of a reduced degree of bonding to create a further pressure-selective seam portion **16** in the bag **1.**

Example 2: a packaging container

[0042] Reference is made to the figures, especially to FIG. 2a to 2d. This example packaging container is an endless tube **44** for FFS packaging. The container is formed from a flexible plastic, for example polyethylene, film wall **2** that has been folded around a longitudinal direction, such that a vent **5,** in the form of a region with an interior **wall 11** and an exterior wall **12** (acting as air-channel-walls defining an air-channel **6** therebetween), is formed between two overlapping outer edges **14** of the film wall **2.** Two seams **9** extending in longitudinal direction fix the outer edges **14** of the film wall **2** to the film wall **2** portion overlapped therewith, and thereby a tube **44** (a so-called FFS tube **44)** is formed, providing a filling-space **15** in the inside of the container. The one of the longitudinal seams **9** ("inner seam **9",** being the leftmost one of the two seams **9** in FIG's 2a and 2b) which is adjacent to the filling-space **15** of the container is a glued seam **9** and the other one of the longitudinal seams **9** ("outer seam **9",** being the rightmost one of the two seams **9** in FIG's 2a and 2b), which is adjacent to the outside **7** of the container, is a welded seam **9.** Before being filled, the packaging container is to be provided with a welded seam **9** perpendicular to the longitudinal direction, forming a bottom **4** and, after having been filled, with a welded seam **9,** also perpendicular to the longitudinal direction, for closing the package **32.** The internal venting means **10** comprise openings formed by interruptions in the gluing of the glued longitudinal inner seam **9,** and pressure-selective external venting means are constituted by pressure-selective seam portions **16,** of reduced degree of bonding, in the welding of the outer seam **9,** the pressure-selective seam portions **16** being arranged in a staggered, offset manner in relation to the openings of the inner seam **9.** In the pressure-selective seam portions **16** the surface of the flexible walls **2** was treated with Corona discharge before welding and therefore in these pressure-selective seam portions **16** the seam **9** has a reduced degree of bonding sufficient to allow gas **29** to escape in response to a suitable predetermined pressure. Also, the surface part of the interior wall **11** adjacent to the air-channel **6** has a Corona-treated surface **17** which was treated with Corona discharge in an endless stripe in the longitudinal direction and thereby the aforementioned welded seams **9,** later to be formed perpendicularly to the longitudinal direction to form a bottom **4** and mouth **3** of the container, will also contain, at the Corona-treated surface **17,** pressure-selective seam portions **16** having a reduced degree of bonding sufficient to allow gas 29 to escape in response to a suitable predetermined pressure. A fibrous filter **13,** and simultaneously spacer means, is constituted by a weldable polyethylene nonwoven inserted in the air-channel **6** between the interior wall **11** and the exterior wall **12,** and also partly within the inner seam **9,** and thus it also provides spacer means in the openings constituted by the interruptions in the glued inner seam **9.** As it can be seen in this example, the vent **5** is formed to comprise a region of the flexible plastic wall 2 having an interior wall **11** and an exterior wall **12** and the vent **5** is free of openings penetrating through an interior wall **11.** (It is also possible for the skilled person to modify this construction and to provide in the wall **2** of the container, for a better venting, two parallel vents **5** of such kind /not shown in figure/ but care must be taken in order that then both of the vents **5** must be free of openings penetrating through an interior wall **11** for conducting gas **29** from inside the container into a region between interior wall **11** and exterior wall **12.)**

Example 3**:** a packaging container

[0043] Reference is made to the figures, especially to FIG. 3a to 3e. This example packaging container is an

open-mouth flat bag **1.** It comprises two opposed bag walls **2** of a thickness of 150 microns, a top open mouth **3** and a cross welded bottom **4.** One of the bag walls **2** comprises two vents **5,** each adapted to conduct air from the inside of the bag **1** into an air-channel **6** and from the air-channel **6** to the outside **7** of the bag **1.** In both vents **5** uniformly, the construction of the vent **5** is such as the vent **5** has two air-channel-walls, generally parallel with the said one of the bag walls **2,** of a thickness of 90 microns, between which the vent **5** has an air-channel **6** adapted to provide a path, for air, in and along the air-channel **6** between the air-channel-walls. The air-channel **6** runs in a longitudinal direction and connects the bottom **4** and the open mouth 3. The air-channel-walls form an air-channel **6** of a generally flat envelope shape. One of the air-channel-walls ("outer air-channel-wall" **18)** is adjacent to, and generally abutting with, the inner surface **8** of the bag wall **2** to which the vents **5** belong and the other air-channel-wall ("inner air-channel-wall" **19)** is adjacent to the filling-space **15** of the bag **1.** The outer air-channel-wall **18** and the inner air-channel-wall **19** meet in two longitudinal seams **9:** one of them (the leftmost one in FIG 3b) is a folded seam **9** and the other one (the rightmost one in FIG 3b) is a welded seam **9.** The folded seam **9** is generally loose from the inner surface **8** of the bag wall **2** while the welded seam **9** is a seam **9** in which also the inner surface **8** of the bag wall **2** is welded to the outer air-channel-wall **18.** The air-channel **6** is thus defined by the said folded seam **9** and welded seam **9** and it is further defined by a welded cross seam **9** in the bottom **4** and further by the open mouth **3**. (In a later use, the open mouth **3** is adapted to be closed with a cross welding which will complete the defining of the air-channel **6** by closing the other end thereof /not shown/.) The surface of the outer air-channel-wall **18** adjacent with the air-channel **6** is a lacquered surface **20,** i.e. a surface covered in a suitably thin layer of a suitable lacquer which causes the cross-welded ends of the air-channel **6,** in the bottom **4** of the bag **1** and, after a closing /not shown/ of the mouth **3,** in the mouth **3** of the bag **1,** to be pressure-selective seam portions **16,** having a reduced degree of bonding sufficient to allow gas **29** to escape in response to a suitable predetermined pressure. Internal venting means **10** are constituted by perforation openings **penetrating** through the outer air-channel-wall **18** (FIG. 3d) and through the folded seam **9** (FIG. 3c). Thus the inner air-channel-wall **19** is, in both of the vents 5, free of perforations. Embossed projections **21,** of a projection height **22** of about 100 microns, are provided as spacer means distributed uniformly and with a suitable closeness in the whole surface, adjacent to the inner surface **8** of the bag wall **2,** of the outer air-channel-wall **18** as well as in the whole surface, adjacent to the air-channel **6,** of the inner air-channel-wall **19.**

Example 4: a packaging container

[0044] Reference is made to the figures, especially to FIG. 4a to 4e. This example packaging container is an endless tube **44** for FFS packaging. The container is formed from an endless flexible plastic flat film wall **2** with two side edges **14,** by folding the film wall **2** around a longitudinal direction, and by adjoining the two symmetrical side edges **14** and folding them into an inside of the container FFS tube, as is illustrated in the relevant drawings (e.g. FIG 4a, 4c). Both wall **2** edges **14** project sharply, essentially perpendicularly from the inner surface **8** of the container wall **2** ("base surface"), into the filling-space **15** of the container with a positive projection height **22,** corresponding to a projection height **22** of the vent **5.** The wall **2** edges **14,** projecting into the filling-space **15,** are fastened to each other with a welded, so-called distal seam **23** which is distal from the inner surface **8** of the container wall **2,** i.e., from the base surface, and whose plane is generally normal to the base surface. The wall **2** portions folded into the inside of the container are further adjoined in another welded, so-called proximal seam **24,** which is adjacent to the inner surface **8** of the container wall **2,** i.e., to the base surface , and whose plane is also generally normal to the base surface. The parts, of the folded-in wall 2 portions, between the distal seam **23** and the proximal seam **24** constitute air-channel side-walls **45** and the air-channel **6** is defined by the air-channel side-walls **45,** the distal seam **23** and the proximal seam **24.** The air-channel **6** thus has an envelope shape sharply projecting into the inner filling-space **15** of the container providing the projecting air-channel **6** with a positive projection height **22,** in which structure the flat envelope of the air-channel **6** is essentially perpendicular to the portion of the tube **44** wall **2** to which it belongs. The two air-channel side-walls **45** are essentially symmetrical and both are essentially normal to the container wall **2** to which they belong. Surfaces of the air-channel side-walls **45** adjacent to the air-channel **6** are provided with embossed projections **21** projecting into the air-channel **6,** as spacer means. Before being filled, the packaging container is to be provided with a welded bottom **4** seam **9** perpendicular to the longitudinal direction, forming the bottom **4** and, after having been filled, with a welded mouth **3** seam **9,** also perpendicular to the longitudinal direction, for closing a mouth **3** of the package **32.** The internal venting means **10** and external venting means are located between the place of the bottom seam **25** and the place of the mouth seam **26** and preferably as far from both as possible, at least as far from both where it is assured that the vent **5** is freely projecting into the filling-space **15** rather than being distorted by any of the bottom **4** seam **9** and mouth **3** seam **9.** The external venting means are constituted by pressure-selective seam portions **16** in the proximal seam **24** (see FIG. 4c), in which the welded surface parts of the wall **2** were treated with Corona discharge to an extent suitable for providing the pressure-selective seam portions **16** with a reduced degree of bonding sufficient to allow gas **29** to escape in response to a suitable predetermined pressure. The suitable extent can, for example, be found with

trial and error at any given application. The internal venting means **10** are constituted by perforation openings penetrating through the air-channel side-walls **45,** preferably nearer to the proximal seam **24** than to the distal seam **23** (see FIG. 4e). The openings constituting the external venting means are formed in a staggered, offset manner in relation to the openings constituting the internal venting means **10.**

Example 5: a packaging container

[0045] Reference is made to the figures, especially to FIG. 5a to 5e. This example packaging container is an endless tube **44** for FFS packaging and differs from the container of Example 4 in that the internal venting means **10** are constituted by openings penetrating through the distal seam **23,** the openings constituted by interruptions in the welding of the distal seam **23.** In the interruptions embossed spacer projections **21** are provided for keeping the openings free for a gas-conducting. The vent **5** is provided with a relatively lower projection height **22** at the interruptions and with a relatively larger projection height **22** elsewhere.

Example 6 : a packing method

[0046] Reference is made to the figures, especially to FIG. 6 to 7. The granular product **27,** provided, is a cement based dry adhesive powder, containing, among others, quartz sand, and with a total cement content of about 30 mass percent. At least about 1 mass percent of the adhesive powder has a granule size below 5 microns. At least about 10 mass percent of the adhesive powder has a granule size below 150 microns. In our separate test, such adhesive powder proved suitable to be mixed with air and thereby to be rendered into an aerated state in which an apparent density of the adhesive is about 79% of its apparent density in a fully compacted state thereof. We found that 120 seconds after the aerated adhesive powder was put at rest, its apparent density was still far lower than 87% of its apparent density in its fully compacted state. For producing the package **32,** a packaging bag **1** according to Example 1 is provided. As it is shown in FIG. 6a., the bag **1** is kept suspended and propped up with its open mouth **3** looking upwards. 25 kg's of the granular product **27** is prepared in a hopper **28** for filling. It is a solid state material in the hopper **28.** As the granular product **27** is made to drop from the hopper **28,** it immediately is mixed with gas **29** (air) and thereby a fluidized filling mixture, i.e. a fluid **30** is provided, having an apparent density which is about 79% of the apparent density of the fully compacted adhesive powder. The fluid **30** is filled into the packaging bag **1** through its open mouth **3.** Referring now to FIG. 6b., after the filling, the open mouth **3** of the bag **1** is closed with a cross seam **9** by welding means **31.** Under the cross seam **9,** there is a small quantity of gas **29** in the bag **1** whose pressure is the same as the ambient atmospheric pressure. This could be performed in an FFS apparatus. Then, as can be seen in FIG. 6c., essentially without delay the produced package **32** is released from the suspended and supported state and placed, in an essentially vertical orientation, onto a horizontal conveyor **33** on which it is started to immediately be conveyed in a horizontal conveyor-direction **34.** Then, as illustrated in FIG. 6d., with a fixed tossing bar **35** positioned above the conveyor **33,** the package **32** is tossed, moved in a tossing direction **36,** into a horizontal orientation and is caused to lie on the conveyor **33** in a suitable venting orientation with its vent **5** being in its top bag wall panel **37** (see FIG. 6e.). Here, and further downstream, the conveyor **33** is provided with a vibrator **38** underneath, for subtly vibrating the package **32** for an enhancing of a separation of its gas **29** and solid contents. This way the homogeneous fluid **30**-state contents of the package **32** are rearranged, i.e. redistributed in the bag **1** approximately uniformly, and thereby the package **32** is reshaped into a reshaped package **32** of an inflated pillow-like shape (see FIG. 6e.). This reshaping causes the volume of the package **32** to somewhat decrease and the inner pressure of the package **32** to somewhat increase. Thereby in the package **32** overpressure is provided which can be recognized from its top bag wall panel **37** being taut enough. Now turning to FIG. 6f., at least for 35 seconds (the pressure-keeping time) from this pressurizing of the package **32,** the pressure-selective seam portions **16** of the bag **1** withstand the overpressure provided in the package **32,** by preventing any gas **29** from escaping from the package **32,** as in the absence of any external squeezing of the package **32.** During the said 35 seconds the lying package **32** is kept in motion in the conveyor-direction **34** on the conveyor **33,** exposed to subtle vibration from underneath. During this period of time the granular product **27** contents within the package **32** largely separate from the gas **29** (air) contents, the granular product **27** settling and compacting at the lowest part of the package **32** and the gas **29** gathering, in a form of a flat bubble of purer and purer air, above the solid-state granular product **27,** the two separated by a phase border **39** getting more and more definite by time. During the said 35 seconds (as settling time) the package **32** is kept free from external squeezing. Thereafter, in order of producing the compacted package **32 ,** essentially full of solid state granular product **27,** as illustrated in FIG. 6h, the package **32** is (as can be seen in FIG. 6g.) externally squeezed by, on the one hand, compressing its two opposed sides horizontally with lateral conveyors (horizontal compressing and lateral conveyors not shown in the figure) and, on the other hand, by pressing essentially its whole top bag wall panel **37** downwards, with an upper squeezing-conveyor **40.** Thereby the top bag wall panel **37** comprising the vent **5** is pressed to, and abutted with, the top surface **41** of the solid bulk of the granular product **27** contents in the bag **1**. The circumstances of the squeezing and venting are illustrated in more details in FIG. 7, as follows. In the bag **1**, the vent **5** comprises (also see FIG. 1) a

region of the flexible plastic wall **2,** which is now in the top bag wall panel **37,** having an interior wall **11** and an exterior wall **12.** The interior wall **11** (which separates the air-channel **6** and the inner filling-space **15** of the bag **1**) is free of openings penetrating therethrough. Instead, internal venting means **10,** being openings for conducting gas **29** from the filling-space **15** of the container into the air-channel **6,** i.e. between the interior **11** and exterior walls **12** of the vent **5,** are comprised of interruptions of the weld line in the welded seam **9** separating the inner filling-space **15** of the bag **1** from the air-channel **6.** When the top bag wall panel **37** is pressed down, the interior wall **11** of the vent **5** is abutted on the top surface **41** of the granular product **27.** This top surface **41** is, by this time of abutting, relatively compact, densified, which prevents the abutting interior wall **11** from too much immersing in it. A space **42,** between the inner surface **8** of the top bag wall panel **37** and the top surface **41** of the granular product **27** is maintained with the help of the interior wall **11** and the fibrous filter **13** in the air-channel **6** the fibrous filter **13** simultaneously also acting as spacer means in the opening. In the maintained space **42,** purified gas **29** can, in response to the internal pressure of the package **32** being increased by the external squeezing, flow, in an air-flow direction **43,** staying above the top surface **41** of the granular product **27,** from the air bubble in the top range of the package **32** directly into the air-channel **6** through the said openings constituting internal venting means **10.**

Example 7 : a packing method

[0047] Reference is made to the figures, especially to FIG. 6, FIG. 7a and FIG. 8. This example method differs from the method of Example 6 in that the packaging bag **1** according to Example 4 is provided for the packing. The circumstances of the squeezing and venting are illustrated in more details in FIG. 7a and FIG. **8,** as follows. In the bag **1,** the vent **5** projects sharply into the filling-space **15** of the bag 1 and comprises (also see FIG. 4) a distal seam **23** and a proximal seam **24,** the two, together with the air-channel side-walls **45,** defining the air-channel **6.** The internal venting means **10** are constituted by perforation openings penetrating through the air-channel side-walls **45,** nearer to the proximal seam **24** than to the distal seam **23.** When the top bag wall panel **37** is pressed down, the distal seam **23** of the vent **5** is abutted on the top surface **41** of the granular product **27.** This top surface **41** is, by this time of abutting, relatively compact, densified, which prevents the abutting distal seam **23** from too much immersing in it. A space **42,** between the inner surface **8** of the top bag wall panel **37** and the top surface **41** of the granular product **27** is maintained with the help of the vent **5.** In the maintained space **42,** purified gas **29** can, in response to the internal pressure of the package **32** being increased by the external squeezing, flow, in air-flow directions **43,** staying above the top surface **41** of the granular product 27, from the air bubble in the top range of the package **32** directly into the air-channel 6 through the said openings constituting internal venting means 10.

Example 8 : a packing method

[0048] Reference is made to the figures, especially to FIG. 6, FIG. 7a and FIG. 9. This example method differs from the method of Example 6 in that the packaging bag 1 according to Example 5 is provided for the packing. The circumstances of the squeezing and venting are illustrated in more details in FIG. 7a and FIG. 9, as follows. In the bag **1,** the vent **5** projects sharply into the filling-space **15** of the bag **1** and comprises (also see FIG. 5) a distal seam **23** and a proximal seam **24,** the two, together with the air-channel side-walls **45,** defining the air-channel **6.** The internal venting means **10** are constituted (also see FIG. 5e) by openings penetrating through the distal seam **23,** the openings constituted by interruptions in the welding of the distal seam **23.** When the top bag wall panel **37** is pressed down, the distal seam **23** of the vent **5** is abutted on the top surface **41** of the granular product **27.** In the maintained space **42,** purified gas **29** can, in response to the internal pressure of the package **32** being increased by the external squeezing, flow, in air-flow directions **43,** staying above the top surface **41** of the granular product **27,** from the air bubble in the top range of the package **32** directly into the air-channel 6 through the said openings constituting internal venting means **10.**

Comparative Example 9 : a comparative example from the prior art

[0049] Reference is made to FIG. 10. The circumstances of the squeezing and venting in typical a prior-art solution are illustrated in details, for comparison, in FIG. 10, as follows. In a typical prior-art venting process the package **32** comprises a typical prior-art vented bag **1,** and has the vent **5** in its top bag wall panel 37. The typical prior-art vent **5** has an interior wall **11** and an exterior wall **12.** The interior wall **11** (which separates the air-channel 6 from the inner filling-space **15** of the bag 1) comprises, as internal venting means **10,** perforation openings penetrating therethrough. In the typical traditional prior-art process the venting starts latest immediately after the filling and reshaping/flattening, as soon as an overpressure is started to be built up in the bag **1,** at which moment the bag **1** is full of stirred-up fluid **30.** In a process, spontaneously driven by the overpressure in the bag **1** and especially driven, in addition, by an additional typical immediate aggressive external squeezing by a squeezing-conveyor **40,** the homogeneous fluid **30** is driven, in an air-flow direction **43,** out of the filling-space **15** of the bag **1** into the air-channel **6** through the perforation openings constituting internal venting means **10,** which loads the air-channel **6** with fluid **30** eventually leaving residual pollution in the air-channel **6,** thus illus-

trating the drawback of the prior art.

Comparative Example 10 : a comparative example from the prior art

[0050] Reference is made to FIG. 11. The circumstances of the squeezing and venting in another prior-art process are illustrated in details, for comparison, in FIG. 11, as follows. The package **32** comprises a prior-art vented bag **1, and** has the vent **5** in its top bag wall panel **37.** The prior-art vent **5** has an exterior wall **12** and an interior wall **11,** the latter with perforation openings penetrating therethrough, constituting internal venting means **10.** The figure shows what happens if the contents of the package **32** are already somewhat separated at the time of the illustrated venting. In response to an external squeezing by the squeezing-conveyor **40,** the perforated interior wall **11** is abutted on the top surface **41** of the granular product **27.** In response to the overpressure, gas **29** can only flow, from the air bubble in the top range of the package **32** into the air-channel **6,** in an air-flow direction **43** through a fluid **30** layer under the top surface **41** of the granular product **27,** through the said openings constituting internal venting means **10,** which loads the air-channel **6** with fluid **30** eventually leaving residual pollution in the air-channel **6,** thus illustrating the drawbacks of the prior art.

Example 11 : a system (package)

[0051] Reference is made to the figures and especially to FIG. 6c and FIG 12. A polyethylene packaging bag **1** contains 75 kg's of Portland cement mixed with air. One panel of the flexible polyethylene wall **2** includes a vent **5.** The vent **5** comprises an air-channel **6** being a lengthwise, overlapped region of the wall **2** having an interior wall **11** and an exterior wall **12.** As internal venting means **10,** the vent **5** has perforations in the interior wall **11** for conducting air into the air-channel **6.** Internal venting means **10** can, alternatively, be formed as interruptions in the seam **9** separating the air-channel **6** from the internal filling-space **15** of the bag 1 (see the bag in FIG. 12). The bag **1** is an FFS-made bag **1,** and is defined by crosswise (mouth- **3** and bottom- **4**) welding seams **9.** One of the film surfaces welded in both of the sections of the crosswise welding seams **9** adjacent to the air-channel **6,** the weakened, pressure-selective seam portions **16,** have a pretreat print layer of a separating lacquer which could be, for example, of the type WP74-076D from Company XSYS Print Solution, Germany. The layer thickness of the lacquer layer is formed to adapt the weakened seam **9** to withstand the internal overpressure of the bag **1** up to 1.0 bar pressure. This layer, its shape and thickness, could be formed by trial and error, for example. Both of the said weakened, pressure-selective seam portions **16** open up in response to the inner pressure exceeding the one bar predetermined limit and conduct air from the air-channel **6** to the outside **7** of the bag **1.** Such a pressure can be formed in the package **32** by external squeezing, prior to which the closed package **32** can be handled, including dropping, turning, laying down, vibrating, flattening etc without losing air, since the form of the package **32** is suitably selected, with respect to the contents, in order of preventing the inner pressure of spontaneously reaching the one bar limit without a definite external squeezing. The cement contents could be in an aerated state in which its apparent density is about 79% of its apparent density belonging to the fully compacted state thereof.

Example 12: a packaging container

[0052] Reference is made to FIG 12. This example packaging container is a flat bag **1** FFS tube section, closed with cross welding at its bottom **4** and mouth **3.** The bag **1** has been formed from a polyethylene film wall **2** that has been folded around a longitudinal direction, such that a vent 5, in the form of a region with an interior wall **11** and an exterior wall **12** (acting as air-channel-walls defining an air-channel **6** therebetween), is formed between two overlapping outer edges **14** of the film wall **2.** Two seams **9** extending in longitudinal direction fix the outer edges **14** of the film wall **2** to the film wall **2** portion overlapped therewith. The two longitudinal seams **9** are welded seams. The welding of one of the longitudinal seams **9** ("inner seam **9",** being the leftmost one of the two longitudinal seams **9** in FIG's 12a and 12b) which is adjacent to the filling-space **15** of the bag **1,** has interruptions, forming the internal venting means **10** (see FIG 12c). The welding of the other longitudinal seam **9** is uninterrupted. The surface of the interior wall **11** adjacent the air-channel **6** is provided with embossed projection **21** spacers. Also, the one, of the two overlapping edges **14** of the film wall **2,** which is adjacent the inner seam **9** is provided with embossed projection **21** spacers that keep the internal venting means **10** open. One (alternatively: both) of the film surfaces welded in both of the sections of the crosswise welding seams **9** adjacent to the air-channel 6, the weakened, pressure-selective seam portions 16, have a pretreat print layer of a separating lacquer which could be, for example, of the type WP74-076D from Company XSYS Print Solution, Germany. The layer thickness of the lacquer layer is formed to adapt the weakened seam **9** to withstand an internal overpressure of the bag **1** up 1.0 bar pressure. This layer, its shape and thickness, could be formed by trial and error, for example. Alternatively, we used a water based lacquer of the WP series manufactured by Torda Ink AB, Sweden. The lacquer is available from G.A.C.H. kft, Hungary and is marketed by the manufacturer, specfically for the beverage packaging industry, under the trade name "Easy Opening Lacquer" on the public internet address "http://www.torda.com/page.asp?Menu=3&SubMenu=9&h=Easy+opening+lacquer" where it is alleged to be "a smart and user friendly solution that seals openings that must be opened easily". We made trial-and-

error printings and weldings and found that both parameters, the thickness of the printed lacquer layer and the welding energy (one or both of the welding time and welding temperature), can be used together or alone, to form the reduced bonding strength selected as desired from a definitely wide range, reduced in relation to the maximum welding strength achievable without separation efforts. We experienced that, not surprisingly, with one given print sample the bonding strength can be reproducibly set to values from very weak to markedly strong, with using different welding energies while all of these welding energies proved to produce industrially applicable bag-closing-strength weldings on film surfaces free of lacquer. Bonding strength of the lacquered polyethylene surfaces proved to be much more sensitive to the welding energy than the un-lacquered polyethylene film. We made the present example bag 1 with different welding energies applied to the crosswise welding bar and each of the resulting bags **1** had apparently uniformly strong package closing at the mouth **3** and bottom **4** and they apparently only differed in the bonding strengths (and thereby in the predetermined limit pressures) of their pressure-selective seam portions **16.** Alternatively, the external venting means could also be provided with additional pressure-selective adhesive layer(s) adjacently to the welded pressure-selective seam portions **16** in order of further improving their behavior, for example their re-closure after some venting.

Index of signs of reference

[0053]

1 bag
2 wall
3 mouth
4 bottom
5 vent
6 air-channel
7 outside
8 inner surface
9 seam
10 internal venting means
11 interior wall
12 exterior wall
13 fibrous filter
14 edge
15 filling-space
16 pressure-selective seam portion
17 Corona-treated surface
18 outer air-channel-wall
19 inner air-channel-wall
20 lacquered surface
21 projection
22 projection height
23 distal seam
24 proximal seam
25 place of bottom seam
26 place of mouth seam
27 granular product
28 hopper
29 gas
30 fluid
31 welding means
32 package
33 conveyor
34 conveyor-direction
35 tossing bar
36 tossing direction
37 top bag wall panel
38 vibrator
39 phase border
40 squeezing-conveyor
41 top surface
42 space
43 air-flow direction
44 tube
45 air-channel side-wall

Claims

1. **A packaging container**, comprising a flexible plastic wall (2) which comprises one or more vents (5), the one or more vents (5)

   - o adapted to conduct gas (29) from an inside of the container into an air-channel (6) and from the air-channel (6) to an outside (7) of the container,
   - o having air-channel-walls defining the air-channel (6),
   - o formed to comprise a region of the flexible plastic wall (2) having an interior wall (11) and an exterior wall (12) constituting air-channel-walls defining the air-channel (6) therebetween,
   - o comprising internal venting means (10) for conducting gas (29) from inside the container into the air-channel (6),
   - o at least partly defined by means of at least one sealed or glued seam (9) having in at least a partial region a reduced degree of bonding sufficient to allow gas (29) to escape in response to a suitable pressure,

   characterized in that

   in one or more of the vents (5),

   - o the vent (5) is free of openings
     - ■ penetrating through an interior wall (11)
     - ■ for conducting gas (29) from an inner filling-space of the container into a region between interior (11) and exterior walls (12).

2. The packaging container according to claim 1, wherein each of the one or more vents (5) are improved in accordance with claim 1.

3. The packaging container according to any of claims 1-2, wherein the internal venting means (10) comprise one or more openings selected from a perforation in a folded seam (9) defining a vent (5), an interruption of a welding in a welded seam (9) defining a vent (5) and an interruption of a gluing in a glued seam (9) defining a vent (5).

4. The packaging container according to claim 3, wherein it has spacer means provided in at least one of the one or more openings in a seam (9) defining a vent (5).

5. The packaging container according to claim 4, wherein the spacer means comprise one or both of a nonwoven and at least one projection (21) of a projection height (22) of at least 50 microns.

6. **A packing method** in which

○ a granular product is provided, and
○ a package is produced, the package comprising a packaging bag and the package further comprising a quantity of the granular product mixed with a gas, packed into the packaging bag,

○ the packaging bag comprising a flexible plastic wall which comprises a vent for venting the bag in a suitable venting orientation of the bag by conducting gas from an inside of the bag into an air-channel and from the air-channel to an outside of the bag,

■ the vent having air-channel-walls defining the air-channel, and
■ the vent formed to comprise a region of the flexible plastic wall having an interior wall and an exterior wall constituting air-channel-walls defining the air-channel therebetween, and
■ the vent having internal venting means for conducting gas from inside the container into the air-channel and
■ the vent being at least partly defined by means of one or more sealed or glued seams having in at least a partial region a reduced degree of bonding sufficient to allow gas to escape in response to a suitable pressure, and

○ the package is reshaped by at least partially rearranging its contents, for providing the bag in venting orientation and for providing an overpressure in the package at least partly adjacently to internal venting means,
characterized in that
○ such a packaging bag is used in which the vent is free of openings penetrating through an interior wall for conducting gas from an inner filling-space of the bag into a region between interior and exterior walls, and
○ such a packaging bag is used in which at least one of the one or more sealed or glued seams is adapted to open after a pressure-keeping time of at least 1 second, in order to allow gas to escape from the reshaped package only in response to an external squeezing of the package.

7. The method according to claim 6, wherein the at least one seam is opened by means of an external squeezing of the package after a pressure-keeping time of at least 1 second in order to allow gas to escape from the reshaped package.

8. The method according to claim 7, wherein the pressure-keeping time is a period of time of at least 1.5 seconds.

9. The method according to any of claims 6-8, wherein at least 1 mass percent of the provided granular product has a granule size below 150 microns.

10. The method according to any of claims 6-9, wherein the provided granular product is suitable to be mixed with air and thereby to be rendered into, and to remain, at rest, at least for 30 seconds, in an aerated state in which its apparent density is at most 98% of an apparent density belonging to the granular product in a fully compacted state thereof.

11. The method according to any of claims 6-10, wherein the provided granular product contains any one or more of cement, calcium oxide, calcium carbonate and calcium hydroxide.

12. The method according to *any of claims 7-11*, wherein during the pressure-keeping time the at least one sealed or glued seam is prevented from allowing gas to escape from the package.

13. A system comprising a packaging bag (1) containing a quantity of a granular product (27) mixed with a gas (29), the packaging bag (1) comprising a flexible plastic wall (2) which comprises a vent (5), the vent (5)

○ adapted to conduct the gas (29) from an inside of the packaging bag (1) into an air-channel (6) and from the air-channel (6) to an outside (7) of the packaging bag (1),
○ having air-channel-walls defining the air-channel (6), and
○ formed to comprise a region of the flexible plastic wall having an interior wall and an exterior wall constituting air-channel-walls defining the

air-channel therebetween, and
○ at least partly defined by a sealed or glued seam (9) having in at least a partial region a reduced degree of bonding sufficient to allow gas (29) to escape only in response to an overpressure in the packaging bag (1) exceeding a predetermined limit,
characterized in that
the vent is free of openings penetrating through an interior wall for conducting gas from an inner filling-space of the bag into a region between interior and exterior walls, and the predetermined limit is selected from an interval between 0.0001 bars and 10 bars.

14. The system according to claim 13, wherein the predetermined limit is selected from an interval between 0.001 bars and 10 bars.

15. The system according to any of claims 13-14, wherein the predetermined limit is selected from an interval between 0.01 bars and 10 bars.

Patentansprüche

1. Verpackungsbehälter, umfassend eine flexible Kunststoffwand (2), die eine oder mehrere Entlüftungen (5) umfasst, wobei die eine oder mehreren Entlüftungen (5)

○ zum Leiten von Gas (29) aus einer Innenseite des Behälters in einen Luftkanal (6) und vom Luftkanal (6) zu einer Außenseite (7) des Behälters geeignet sind,
○ Luftkanalwände aufweisen, die den Luftkanal (6) definieren,
○ gebildet sind, um eine Region der flexiblen Kunststoffwand (2) zu umfassen, die eine Innenwand (11) und eine Außenwand (12) aufweist, die Luftkanalwände darstellen, die den Luftkanal (6) dazwischen definieren,
○ interne Entlüftungsmöglichkeiten (10) zum Leiten von Gas (20) vom Inneren des Behälters in den Luftkanal (6) umfassen,
○ mindestens teilweise durch mindestens eine versiegelte oder verklebte Naht (9) definiert sind, die in mindestens einer Teilregion einen reduzierten Bindungsgrad aufweist, der ausreicht, um zu gestatten, dass Gas (29) als Reaktion auf einen geeigneten Druck entweicht,
dadurch gekennzeichnet, dass
in einer oder mehreren der Entlüftungen (5)
○ die Entlüftung (5) frei von Öffnungen ist

■ die durch eine Innenwand (11) hindurchdringen
■ zum Leiten von Gas (29) aus einem inneren Füllraum des Behälters in eine Region zwischen Innen- (11) und Außenwänden (12).

2. Verpackungsbehälter nach Anspruch 1, wobei jede der einen oder mehreren Entlüftungen (5) nach Anspruch 1 entsprechend verbessert sind.

3. Verpackungsbehälter nach einem der Ansprüche 1 - 2, wobei die interne Entlüftungsmöglichkeit (10) eine oder mehrere Öffnungen umfasst ausgewählt von einer Perforation in einer gefalzten Naht (9), die eine Entlüftung (5) definiert, wobei eine Unterbrechung einer Schweißung in einer geschweißten Naht (9) eine Entlüftung (5) definiert und eine Unterbrechung einer Klebung in einer verklebten Naht (9) eine Entlüftung (5) definiert.

4. Verpackungsbehälter nach Anspruch 3, wobei er Abstandhaltermöglichkeiten aufweist, die in mindestens einer der einen oder mehreren Öffnungen in einer Naht (9), die eine Entlüftung (5) definieren, bereitgestellt sind.

5. Verpackungsbehälter nach Anspruch 4, wobei die Abstandhaltermöglichkeiten eines oder beide von einem Vliesstoff und mindestens einen Vorsprung (21) einer Vorsprunghöhe (22) von mindestens 50 Mikron umfasst.

6. Verpackungsverfahren, wobei

○ ein granuläres Produkt bereitgestellt wird, und
○ eine Verpackung hergestellt wird, wobei die Verpackung einen Verpackungsbeutel umfasst und die Verpackung des Weiteren eine Menge des granulären Produkts mit einem Gas gemischt in dem Verpackungsbeutel verpackt umfasst

○ wobei der Verpackungsbeutel eine flexible Kunststoffwand umfasst, die eine Entlüftung zum Entlüften des Beutels in einer geeigneten Entlüftungsorientierung des Beutels durch Leiten von Gas aus einer Innenseite des Beutels in einen Luftkanal und vom Luftkanal zu einer Außenseite des Beutels umfasst,

■ wobei die Entlüftung Luftkanalwände aufweist, die den Luftkanal definieren, und
■ die Entlüftung gebildet ist, um eine Region der flexiblen Kunststoffwand zu umfassen, die eine Innenwand und eine Außenwand aufweist, die Luftkanalwände darstellen, die den Luftkanal dazwischen definieren, und

■ wobei die Entlüftung interne Entlüftungsmöglichkeiten zum Leiten von Gas vom Inneren des Behälters in den Luftkanal aufweist und

■ wobei die Entlüftung mindestens teilweise durch eine oder mehrere versiegelte oder verklebte Nähte definiert ist, die in mindestens einer Teilregion einen reduzierten Bindungsgrad aufweisen, der ausreicht, um zu gestatten, dass Gas als Reaktion auf einen geeigneten Druck entweicht, und

○ die Verpackung durch mindestens teilweises Umordnen ihrer Inhalte umgestaltet wird, um den Beutel in Entlüftungsorientierung bereitzustellen und um einen Überdruck in der Verpakkung mindestens teilweise neben der internen Entlüftungsmöglichkeit bereitzustellen,

dadurch gekennzeichnet, dass

○ ein derartiger Verpackungsbeutel verwendet wird, in dem die Entlüftung von Öffnungen frei ist, die durch eine Innenwand hindurchdringen zum Leiten von Gas von einen inneren Füllraum des Beutels in eine Region zwischen Innen- und Außenwänden und

○ ein derartiger Verpackungsbeutel verwendet wird, in dem mindestens eine der einen oder mehreren versiegelten oder verklebten Nähte geeignet ist, sich nach einer Druckhaltezeit von mindestens 1 Sekunde zu öffnen, um zu gestatten, dass Gas von der umgestalteten Verpakkung nur als Reaktion auf ein externes Zusammendrücken der Verpackung entweicht.

7. Verfahren nach Anspruch 6, wobei die mindestens eine Naht durch externes Zusammendrücken der Verpackung nach einer Druckhaltezeit von mindestens 1 Sekunde geöffnet wird, um zu gestatten, dass Gas von der umgestalteten Verpackung entweicht

8. Verfahren nach Anspruch 7, wobei die Druckhaltezeit eine Zeitspanne von mindestens 1,5 Sekunden ist.

9. Verfahren nach einem der Ansprüche 6 - 8, wobei mindestens 1 Masseprozent des bereitgestellten granulären Produkts kleiner als 150 Mikron ist.

10. Verfahren nach einem der Ansprüche 6 - 9, wobei das bereitgestellte granuläre Produkt geeignet ist, mit Luft gemischt zu werden und dadurch mindestens 30 Sekunden lang in einem belüfteten Zustand in Ruhe gebracht und gehalten zu werden, in dem seine Rohdichte höchstens 98 % einer Rohichte beträgt, die zu dem granulären Produkt in einem vollständig komprimierten Zustand davon gehört.

11. Verfahren nach einem der Ansprüche 6 -10, wobei das bereitgestellte granuläre Produkt irgendeines oder mehrere von Zement, Calciumoxid, Calciumcarbonat und Calciumhydrat enthält.

12. Verfahren nach einem der Ansprüche 7 - 11, wobei während der Druckhaltezeit die mindestens eine versiegelte oder verklebte Naht daran gehindert wird, zu gestatten, dass Gas aus der Verpackung entweicht.

13. System umfassend einen Verpackungsbeutel (1), der eine Menge von granulärem Produkt (27) mit einem Gas (29) gemischt enthält, wobei der Verpakkungsbeutel (1) eine flexible Kunststoffwand (2) umfasst, die eine Entlüftung (5) umfasst, wobei die Entlüftung (5)

○ zum Leiten von Gas (29) aus einer Innenseite des Verbackungsbeutels (1) in einen Luftkanal (6) und vom Luftkanal (6) zu einer Außenseite (7) des Verpackungsbeutels (1) geeignet ist,

○ Luftkanalwände aufweist, die den Luftkanal (6) definieren, und

○ gebildet ist, um eine Region der flexiblen Kunststoffwand zu umfassen, die eine Innenwand und eine Außenwand aufweist, die Luftkanalwände darstellen, die den Luftkanal (6) dazwischen definieren, und

○ mindestens teilweise durch eine versiegelte oder verklebte Naht (9) definiert ist, die in mindestens einer Teilregion einen reduzierten Bindungsgrad aufweist, der ausreicht, um zu gestatten, dass Gas (29) nur als Reaktion auf einen Überdruck im Verpakkungsbeutel (1), der eine vorbestimmte Grenze übersteigt, entweicht,

dadurch gekennzeichnet, dass

die Entlüftung frei von Öffnungen ist, die durch eine Innenwand hindurchdringen, zum Leiten von Gas aus einem inneren Füllraum des Beutels in eine Region zwischen Innen- und Außenwänden und die vorbestimmte Grenze aus einem Intervall zwischen 0,0001 bar und 10 bar ausgewählt ist.

14. System nach Anspruch 13, wobei die vorbestimmte Grenze aus einem Intervall zwischen 0,001 und 10 bar ausgewählt ist.

15. System nach einem der Ansprüche 13 - 14, wobei die vorbestimmte Grenze aus einem Intervall zwischen 0,01 und 10 bar ausgewählt ist.

Revendications

1. Récipient de conditionnement, comprenant une paroi en matière plastique souple (2) qui comprend un

ou plusieurs conduits d'évacuation (5), le ou les conduits d'évacuation (5)

- étant adaptés pour conduire du gaz (29) à partir d'un intérieur du récipient dans un canal d'air (6) et du canal d'air (6) à un extérieur (7) du récipient,
- comportant des parois de canal d'air définissant le canal d'air (6),
- étant formés pour comprendre une région de la paroi en matière plastique souple (2) comportant une paroi intérieure (11) et une paroi extérieure (12) constituant des parois de canal d'air définissant le canal d'air (6) entre celles-ci,
- comprenant des moyens d'évacuation internes (10) pour conduire du gaz (29) à partir de l'intérieur du récipient dans le canal d'air (6),
- étant au moins partiellement définis au moyen d'au moins un joint scellé ou collé (9) comportant dans au moins une région partielle un degré réduit de liage suffisant pour permettre à du gaz (29) de s'échapper en réponse à une pression appropriée,

caractérisé en ce que

dans un ou plusieurs des conduits d'évacuation (5),

- le conduit d'évacuation (5) est dépourvu d'ouvertures
- - pénétrant à travers une paroi intérieure (11)
- - pour conduire gaz (29) à partir d'un espace de remplissage intérieur du récipient dans une région entre des parois intérieure (11) et extérieure (12).

2. Récipient de conditionnement selon la revendication 1, dans lequel chacun du ou des conduits d'évacuation (5) est amélioré selon la revendication 1.

3. Récipient de conditionnement selon une quelconque des revendications 1 et 2, dans lequel les moyens d'évacuation internes (10) comprennent une ou plusieurs ouvertures sélectionnées parmi une perforation dans un joint plié (9) définissant un conduit d'évacuation (5), une interruption d'un soudage dans un joint soudé (9) définissant un conduit d'évacuation (5) et une interruption d'un collage dans un joint collé (9) définissant un conduit d'évacuation (5).

4. Récipient de conditionnement selon la revendication 3, dans lequel il comporte des moyens d'espacement fournis dans au moins une de la ou des ouvertures dans un joint (9) définissant un conduit d'évacuation (5).

5. Récipient de conditionnement selon la revendication 4, dans lequel les moyens d'espacement comprennent un ou les deux parmi un non-tissé et au moins une saillie (21) d'une hauteur de saillie (22) d'au moins 50 microns.

6. Procédé de conditionnement, dans lequel

- un produit granulaire est fourni, et
- un conditionnement est produit, le conditionnement comprenant un sac de conditionnement et le conditionnement comprenant en outre une quantité du produit granulaire mélangée avec du gaz, conditionné dans le sac de conditionnement,
- - le sac de conditionnement comprenant une paroi en matière plastique souple qui comprend un conduit d'évacuation pour évacuer le gaz du sac dans une orientation d'évacuation appropriée du sac en conduisant le gaz à partir d'un intérieur du sac dans un canal d'air et à partir du canal d'air vers un extérieur du sac,
- -- le conduit d'évacuation comportant des parois de canal d'air définissant le canal d'air, et
- -- le conduit d'évacuation étant formé pour comprendre une région de la paroi en matière plastique souple comportant une paroi intérieure et une paroi extérieure constituant des parois de canal d'air définissant le canal d'air entre celles-ci, et
- -- le conduit d'évacuation comportant des moyens d'évacuation internes pour conduire du gaz à partir de l'intérieur du récipient dans le canal d'air, et
- -- le conduit d'évacuation étant au moins partiellement défini au moyen d'un ou plusieurs joints scellés ou collés comportant, dans au moins une région partielle, un degré réduit de liage suffisant pour permettre à du gaz de s'échapper en réponse à une pression appropriée, et
- le conditionnement est remis en forme en réagençant au moins partiellement ses contenus, pour fournir le sac dans une orientation d'évacuation et pour fournir une surpression dans le conditionnement au moins de façon partiellement adjacente à des moyens d'évacuation internes,

caractérisé en ce que

- un tel sac de conditionnement est utilisé dans lequel le conduit d'évacuation est dépourvu d'ouvertures pénétrant à travers une paroi intérieure pour conduire du gaz à partir d'un espace de remplissage intérieur du sac dans une région entre des parois intérieure et extérieure, et
- un tel sac de conditionnement est utilisé dans lequel au moins un du ou des joints scellés ou collés est adapté pour s'ouvrir après une période de maintien de pression d'au moins 1 seconde, afin de permettre à du gaz de s'échapper à partir du conditionnement remis en forme seulement en réponse à un serrage externe du condition-

nement.

7. Procédé selon la revendication 6, dans lequel l'au moins un joint est ouvert au moyen d'un serrage externe du conditionnement après une période de maintien de pression d'au moins 1 seconde afin de permettre à du gaz de s'échapper à partir du conditionnement remis en forme.

8. Procédé selon la revendication 7, dans lequel la période de maintien de pression est une période d'au moins 1,5 seconde.

9. Procédé selon une quelconque des revendications 6 à 8, dans lequel au moins 1 pour cent en masse du produit granulaire fourni possède une granulométrie inférieure à 150 microns.

10. Procédé selon une quelconque des revendications 6 à 9, dans lequel le produit granulaire fourni est approprié pour être mélangé avec de l'air et ainsi pour être mis dans, et pour rester, au repos, au moins pendant 30 secondes, dans un état aéré dans lequel sa densité apparente est au plus 98 % d'une densité apparente appartenant au produit granulaire dans un état complètement compacté de celui-ci.

11. Procédé selon une quelconque des revendications 6 à 10, dans lequel le produit granulaire fourni contient un ou plusieurs parmi du ciment, de l'oxyde de calcium, du carbonate de calcium et de l'hydroxyde de calcium.

12. Procédé selon une quelconque des revendications 7 à 11, dans lequel, durant la période de maintien de pression, l'au moins un joint scellé ou collé est empêché de permettre à du gaz de s'échapper du conditionnement.

13. Système comprenant un sac de conditionnement (1) récipient une quantité d'un produit granulaire (27) mélangé avec du gaz (29), le sac de conditionnement (1) comprenant une paroi en matière plastique souple (2) qui comprend un conduit d'évacuation (5), le conduit d'évacuation (5)

- étant adapté pour conduire le gaz (29) à partir d'un intérieur du sac de conditionnement (1) dans un canal d'air (6) et du canal d'air (6) à un extérieur (7) du sac de conditionnement (1),
- comportant des parois de canal d'air définissant le canal d'air (6), et
- étant formé pour comprendre une région de la paroi en matière plastique souple comportant une paroi intérieure et une paroi extérieure constituant des parois de canal d'air définissant le canal d'air entre celles-ci, et
- étant au moins partiellement défini par un joint scellé ou collé (9) comportant, dans au moins une région partielle, un degré réduit de liage suffisant pour permettre à du gaz (29) de s'échapper seulement en réponse à une surpression dans le sac de conditionnement (1) dépassant une limite prédéterminée,

caractérisé en ce que

le conduit d'évacuation est dépourvu d'ouvertures pénétrant à travers une paroi intérieure pour conduire du gaz à partir d'un espace de remplissage intérieur du sac dans une région entre des parois intérieure et extérieure, et la limite prédéterminée est sélectionnée dans un intervalle entre 0,0001 bar et 10 bar.

14. Système selon la revendication 13, dans lequel la limite prédéterminée est sélectionnée dans un intervalle entre 0,001 bar et 10 bar.

15. Système selon une quelconque des revendications 13 et 14, dans lequel la limite prédéterminée est sélectionnée dans un intervalle entre 0,01 bar et 10 bar.

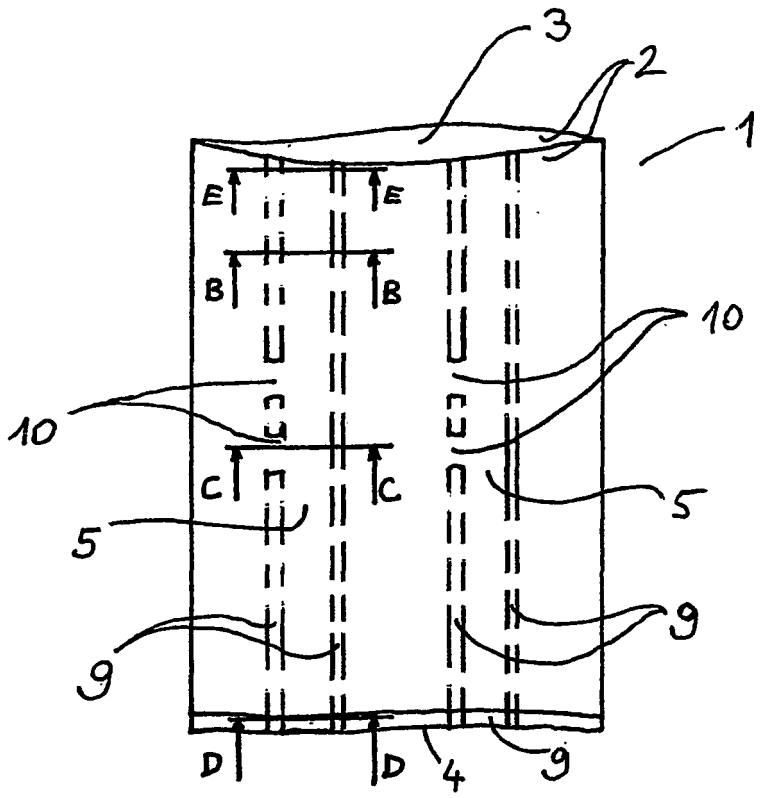


Fig. 1a

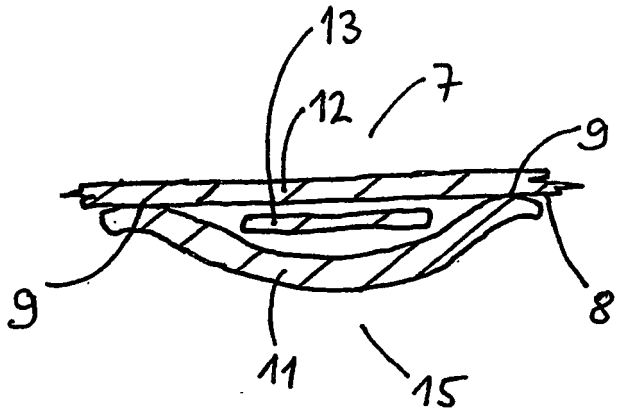


Fig. 1b

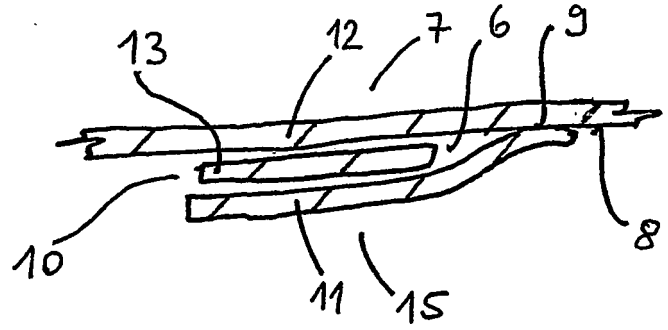


Fig. 1c

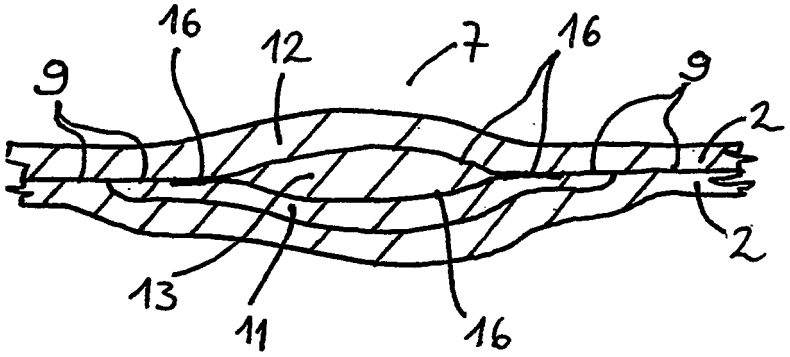


Fig. 1d

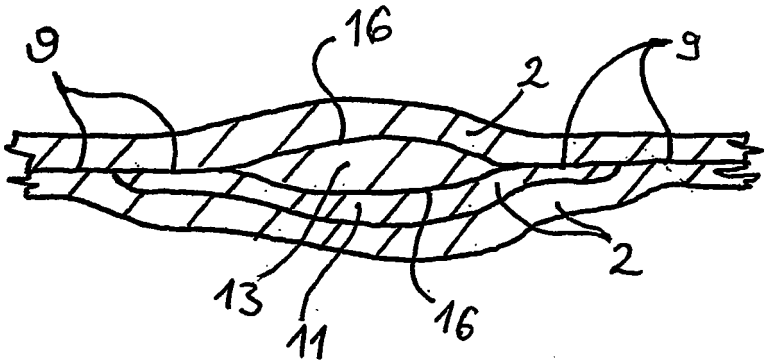


Fig. 1e

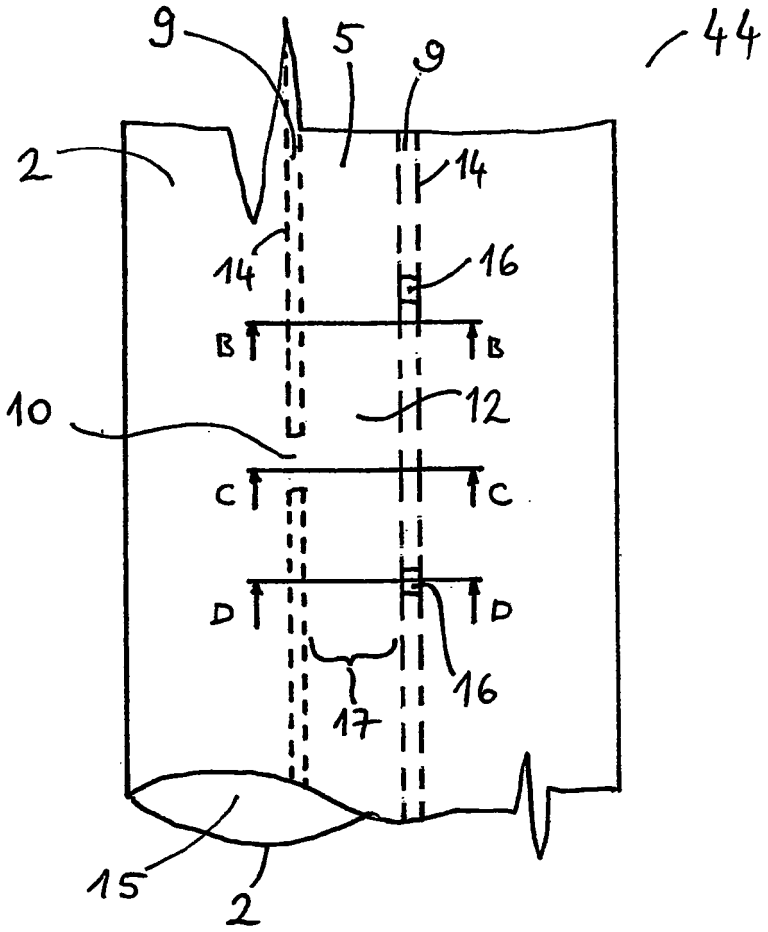


Fig. 2a

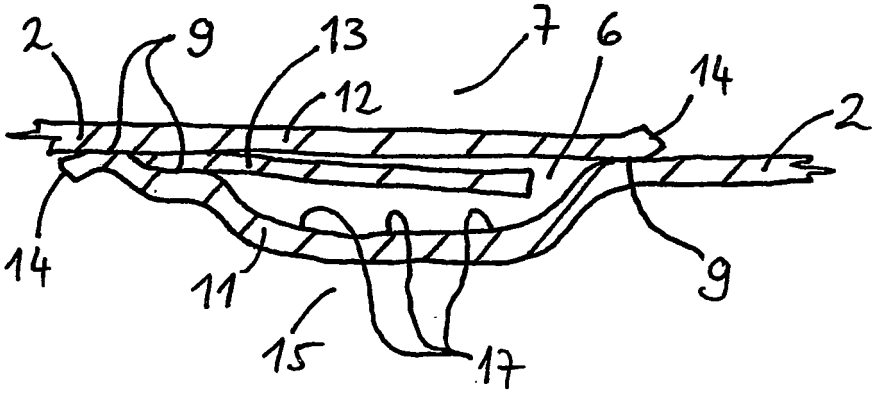


Fig. 2b

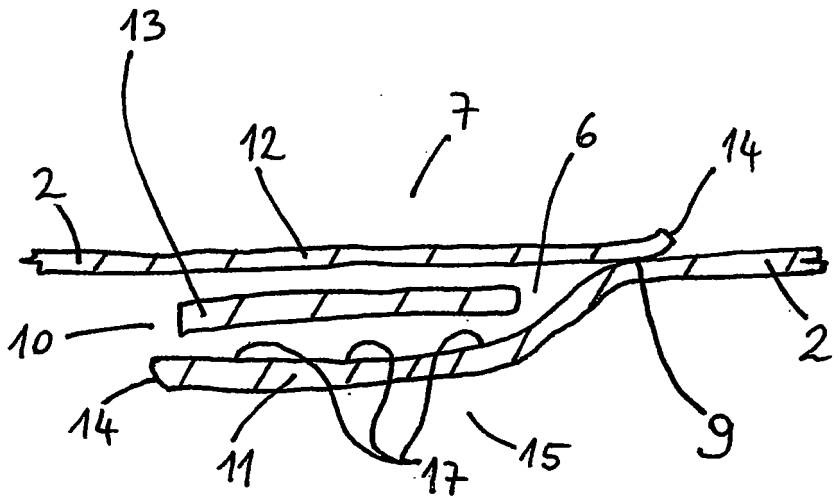


Fig. 2c

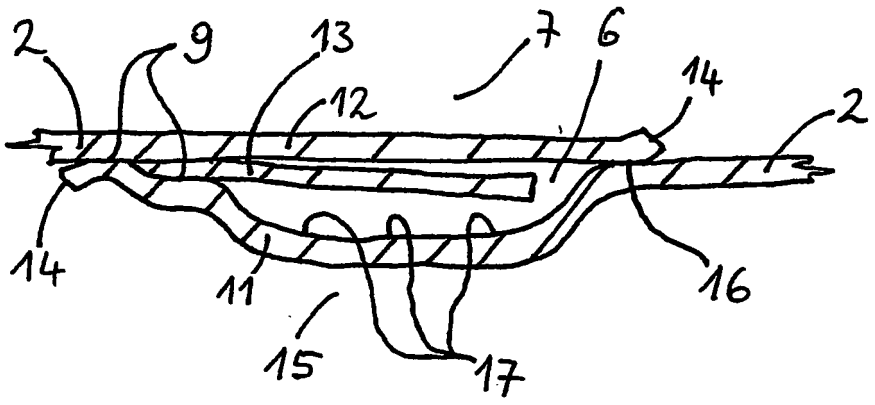


Fig. 2d

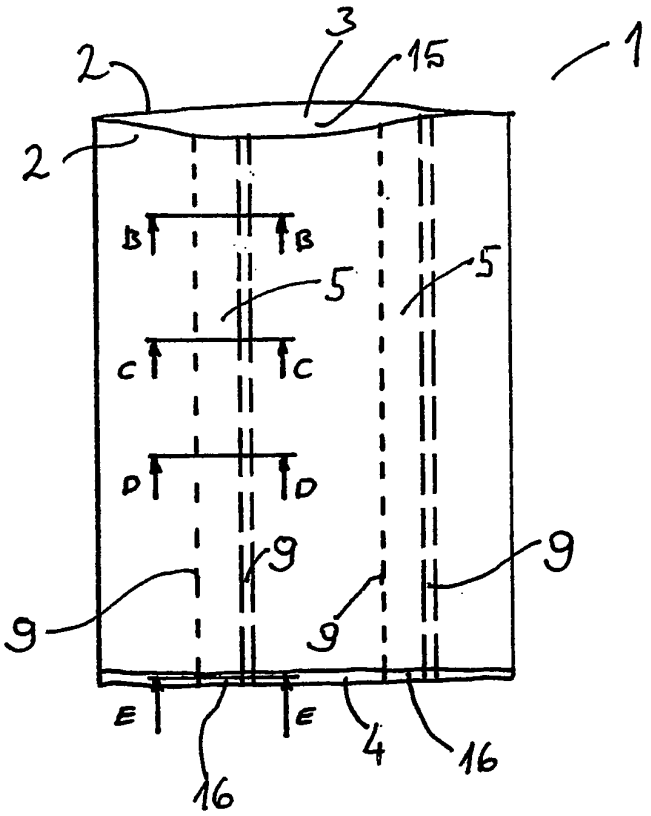


Fig. 3a

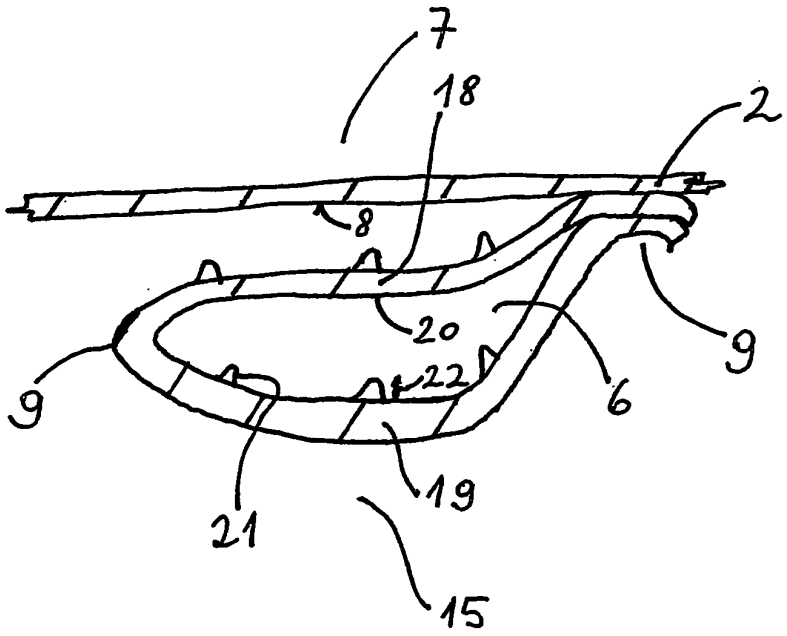


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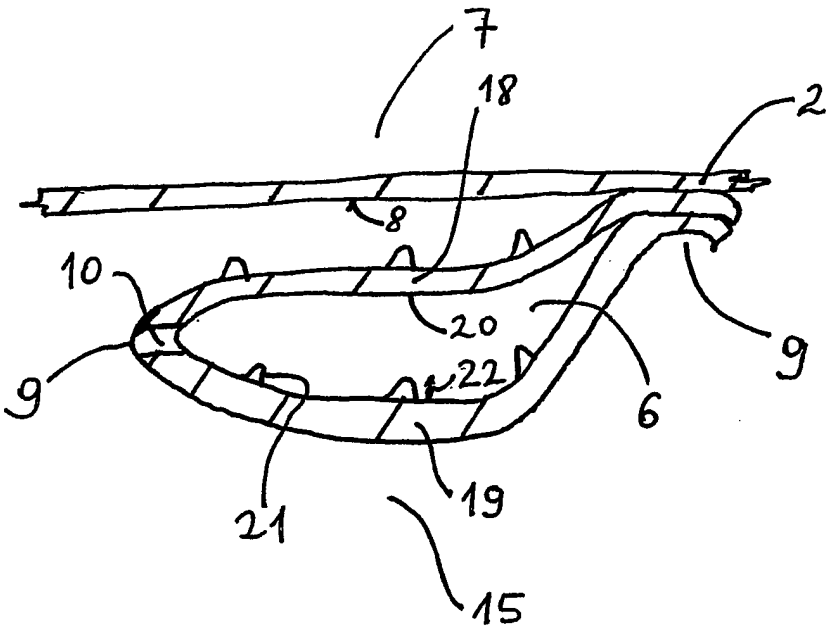


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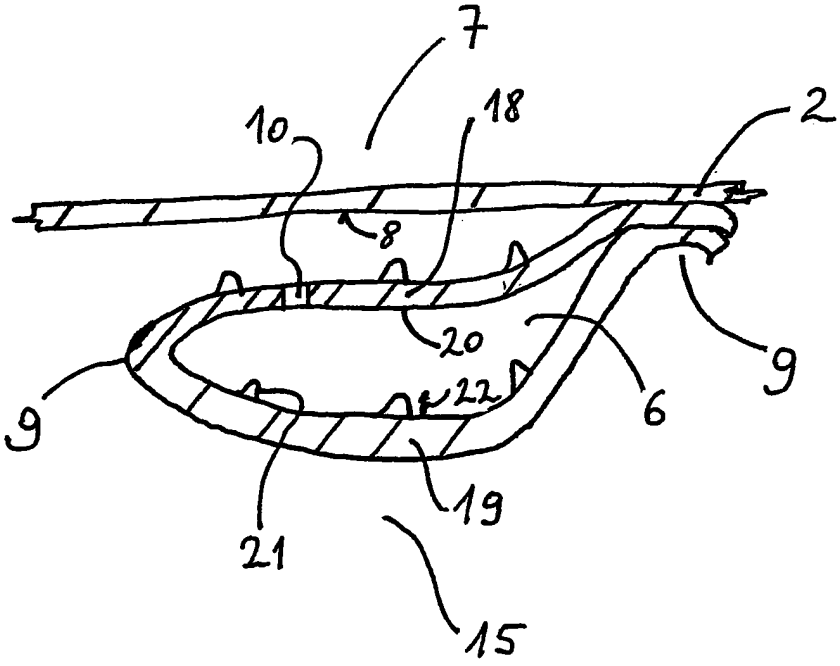


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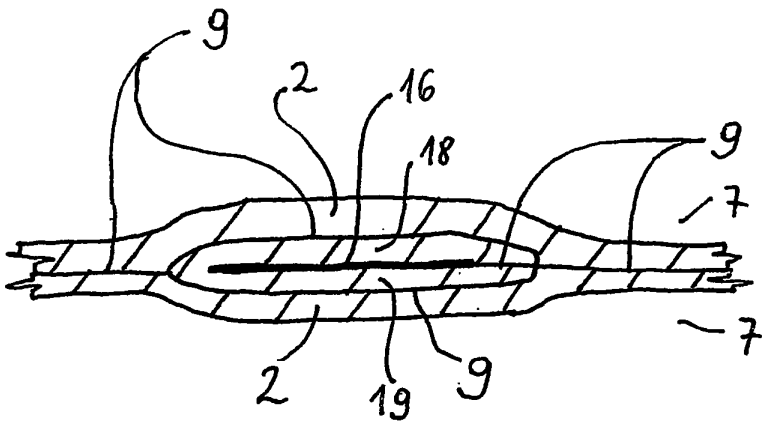


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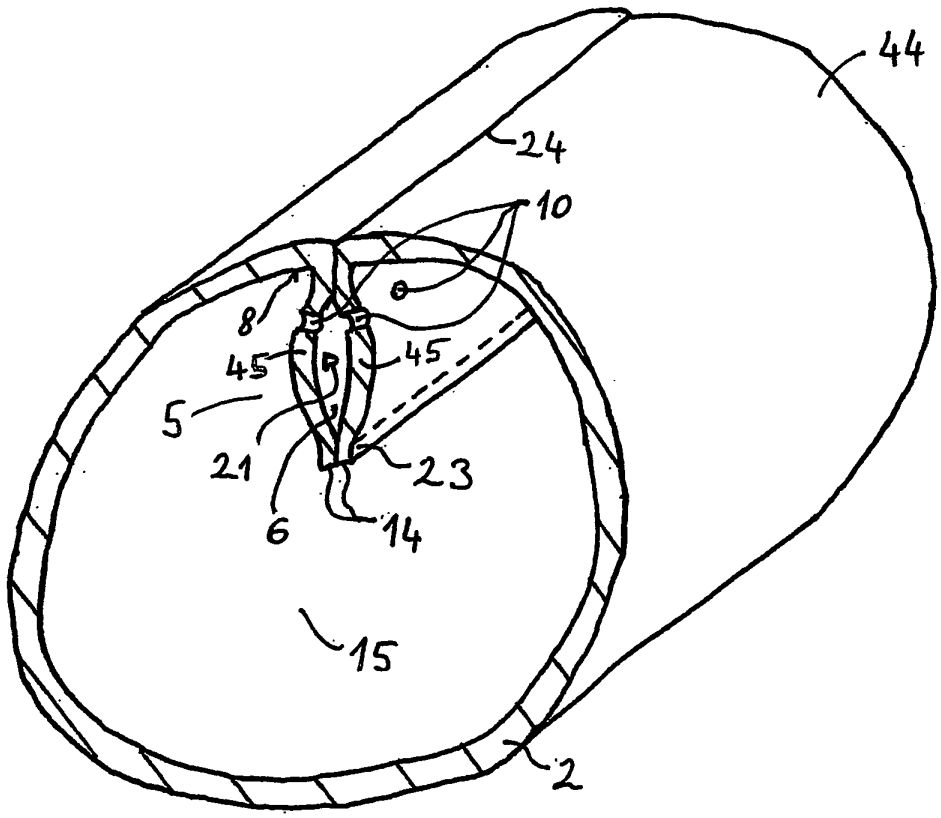


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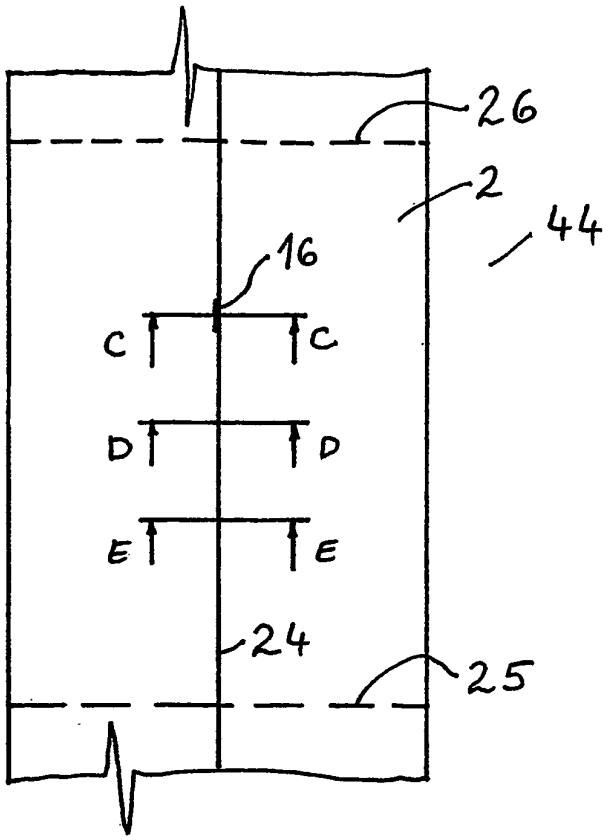


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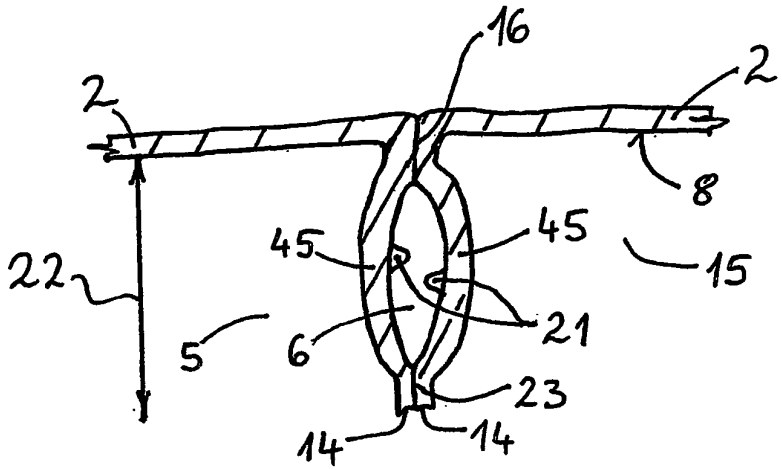


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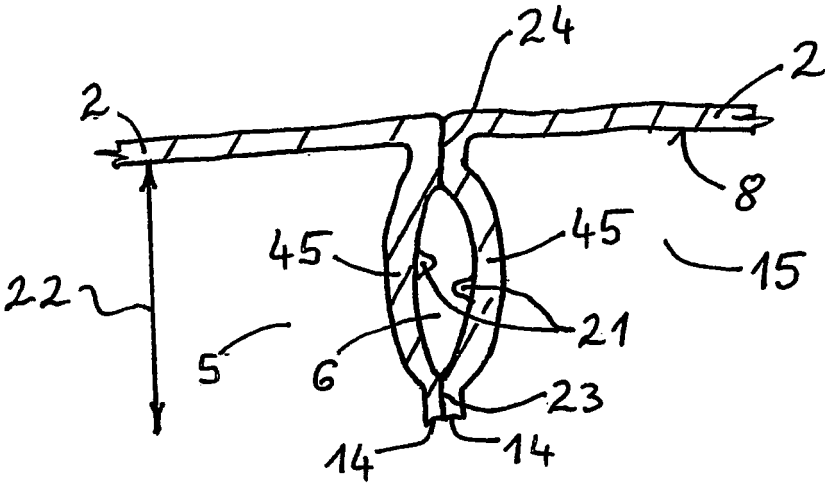

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Fig. 4d

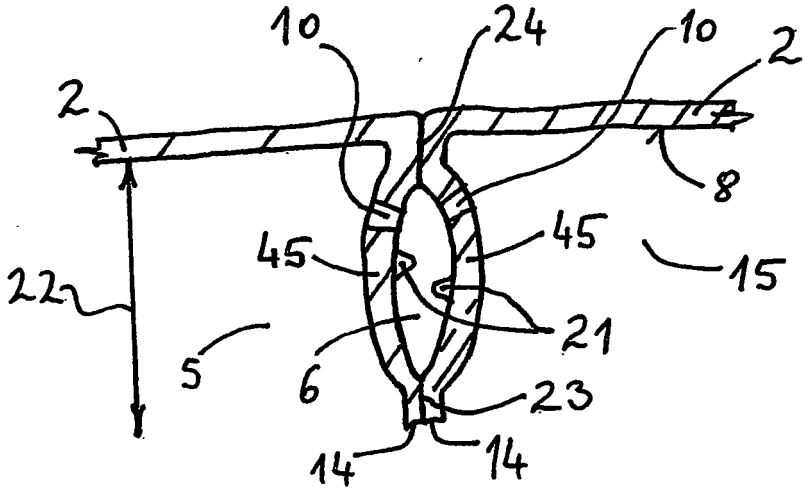

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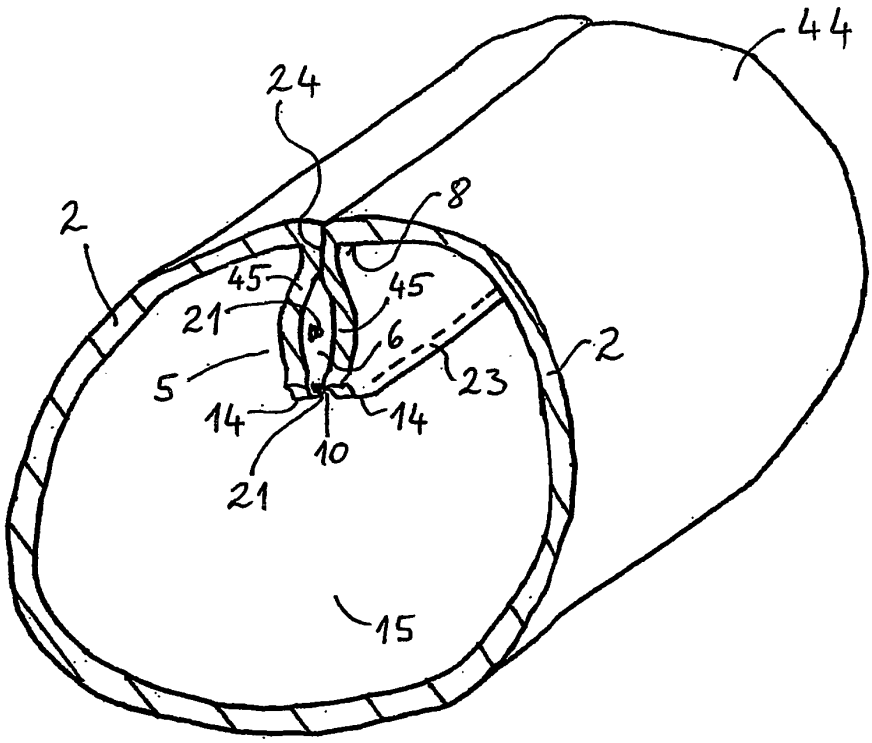


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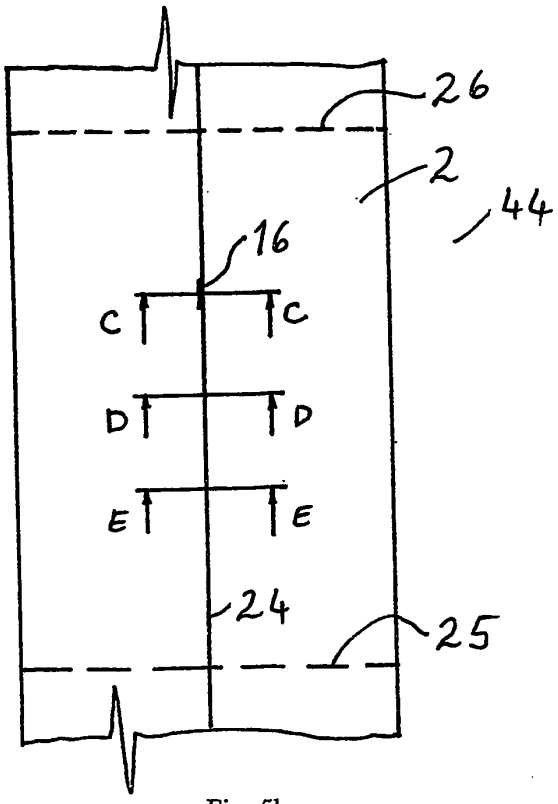


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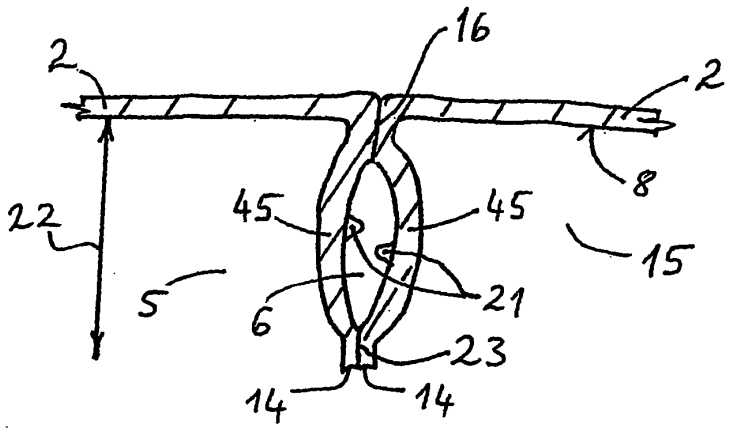


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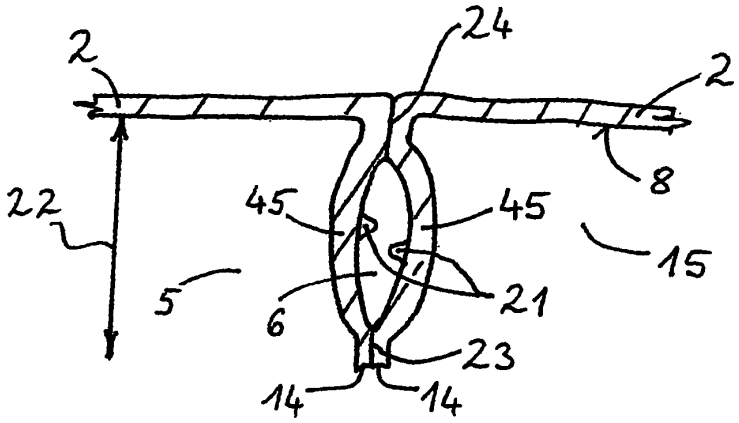


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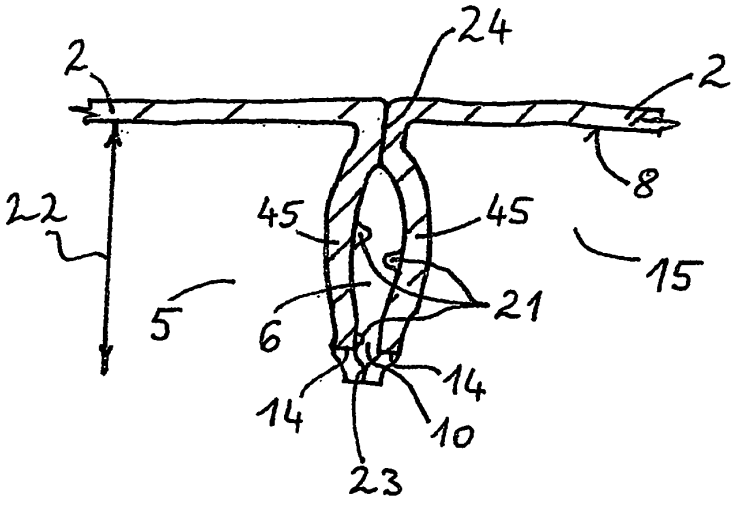


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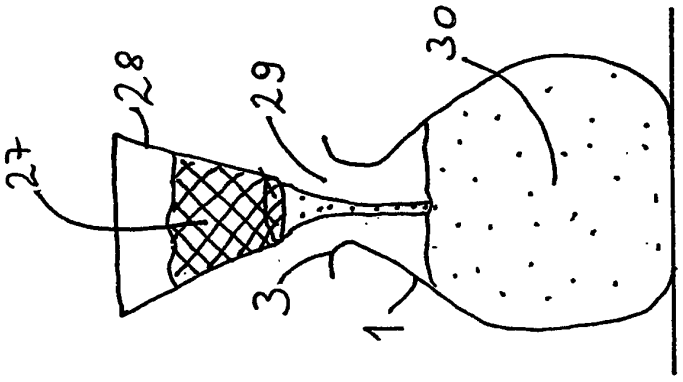


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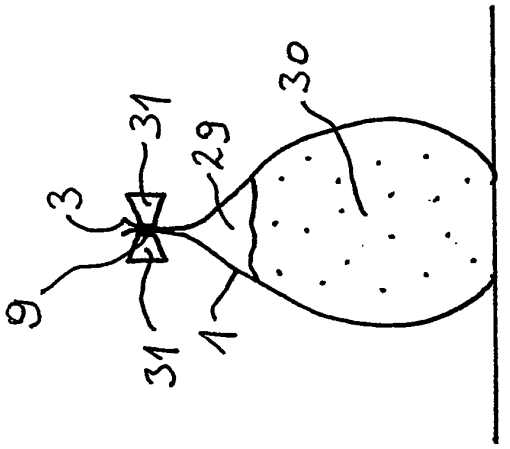


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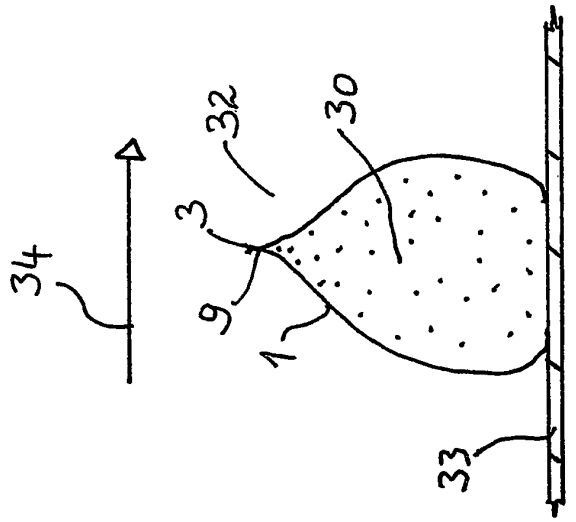


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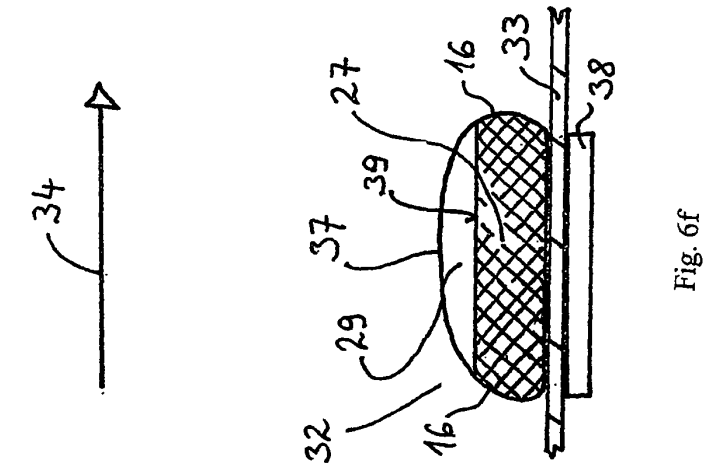


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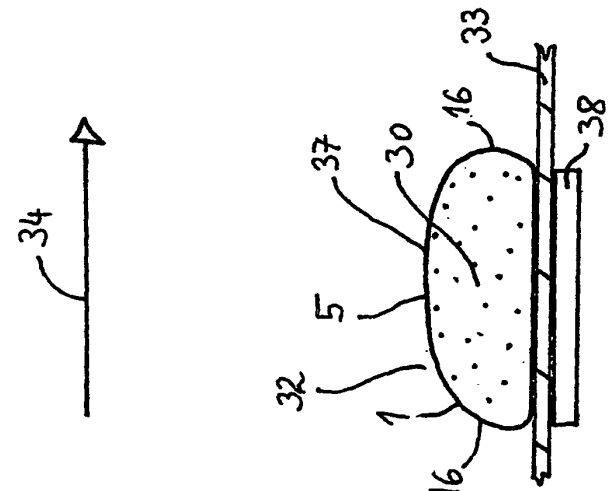


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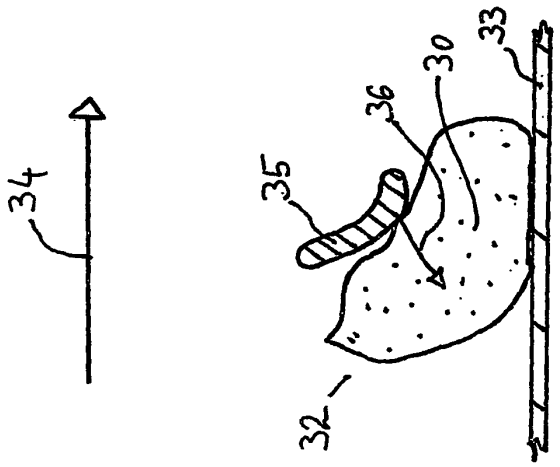


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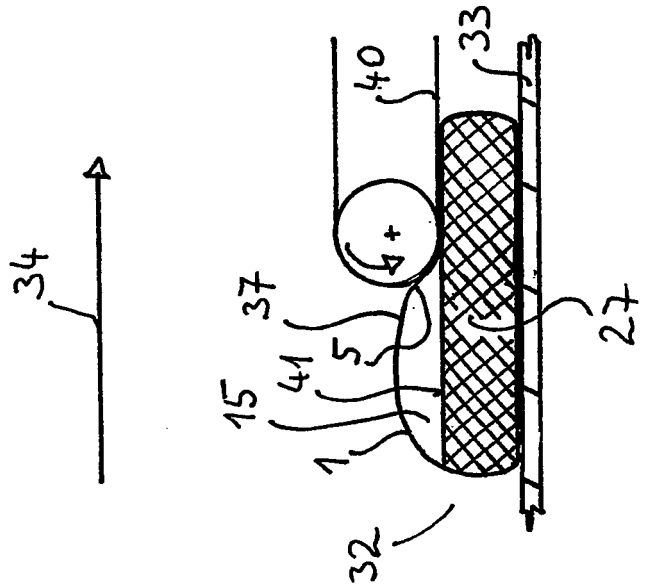


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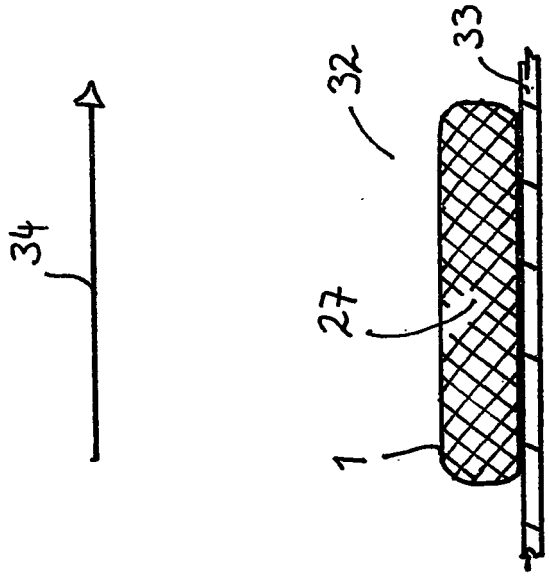


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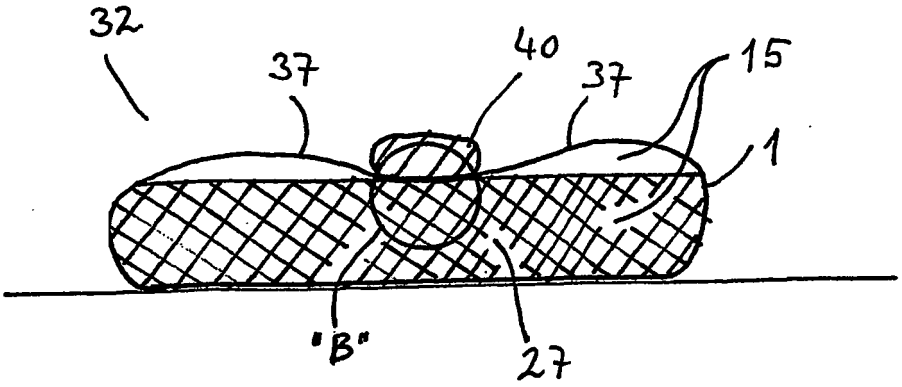


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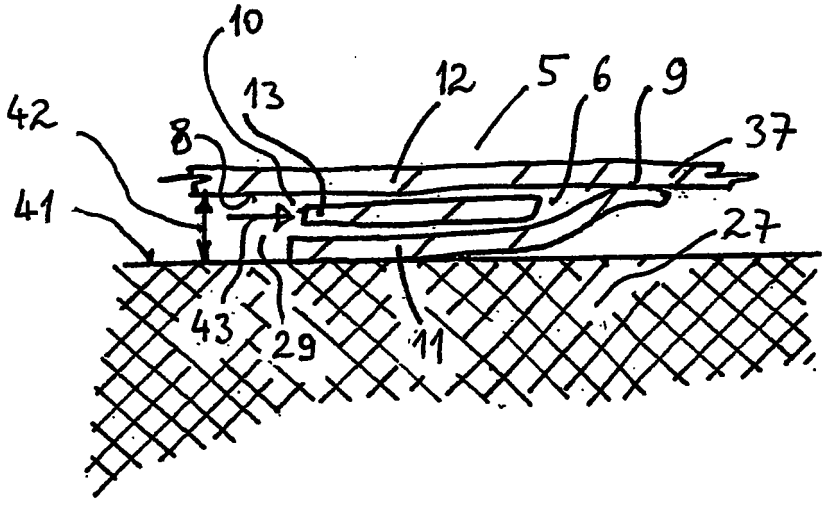


Fig. 7b

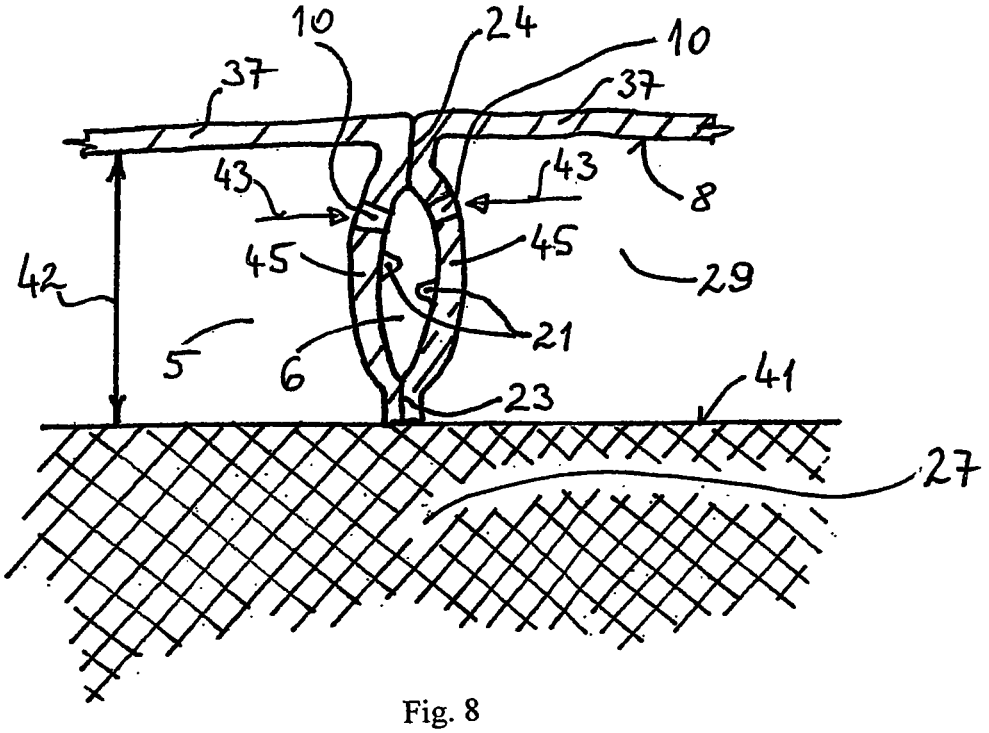

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Fig. 8

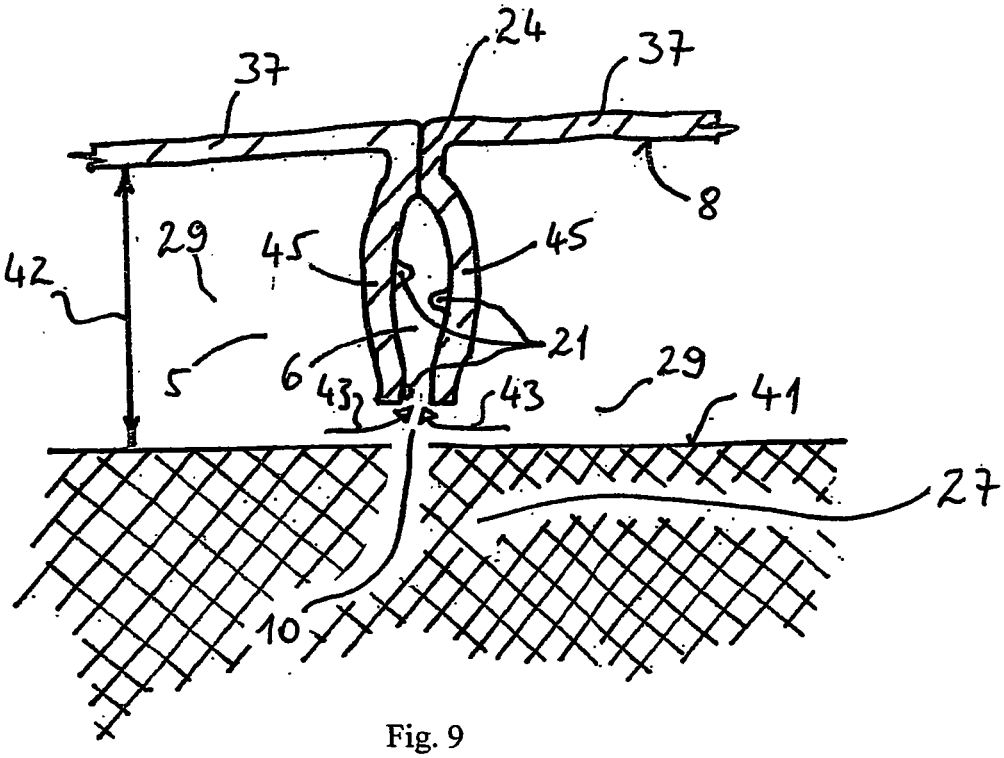

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Fig. 9

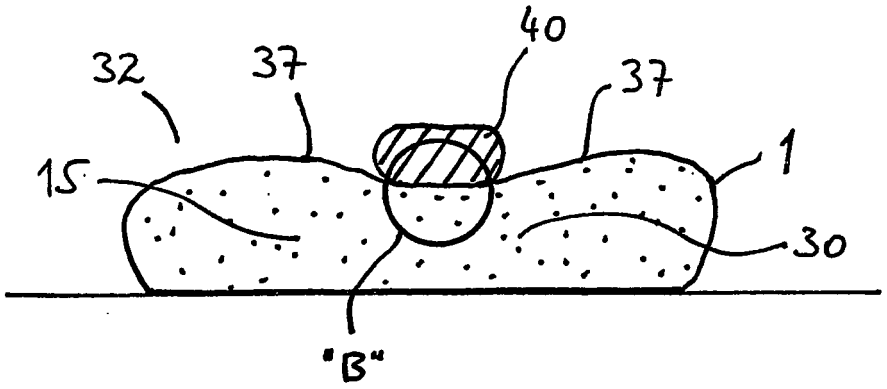


Fig. 10a
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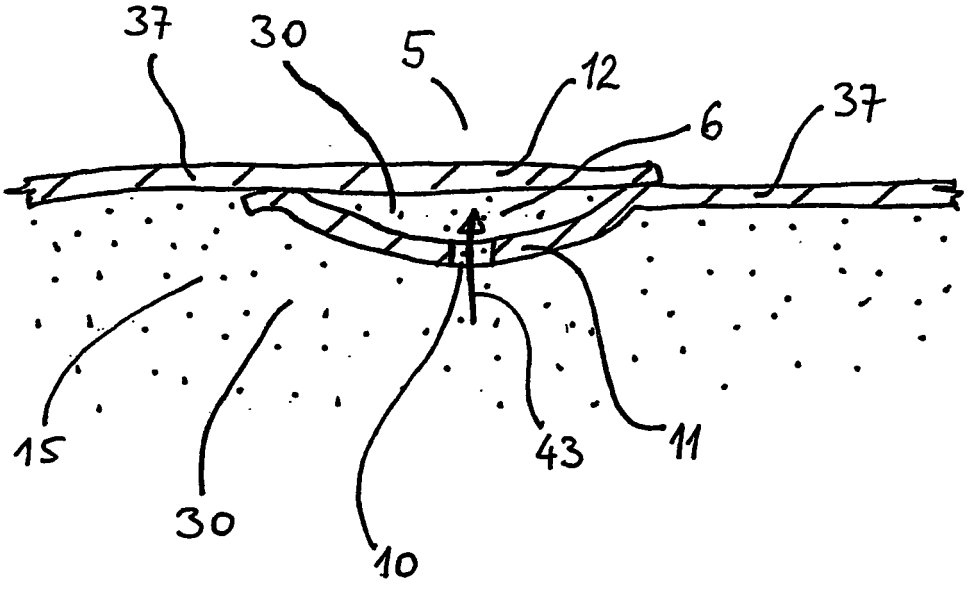


Fig. 10b
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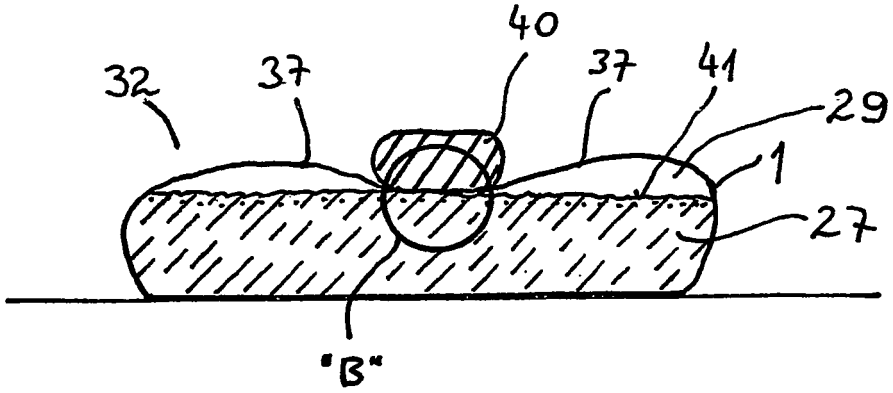


Fig. 11a
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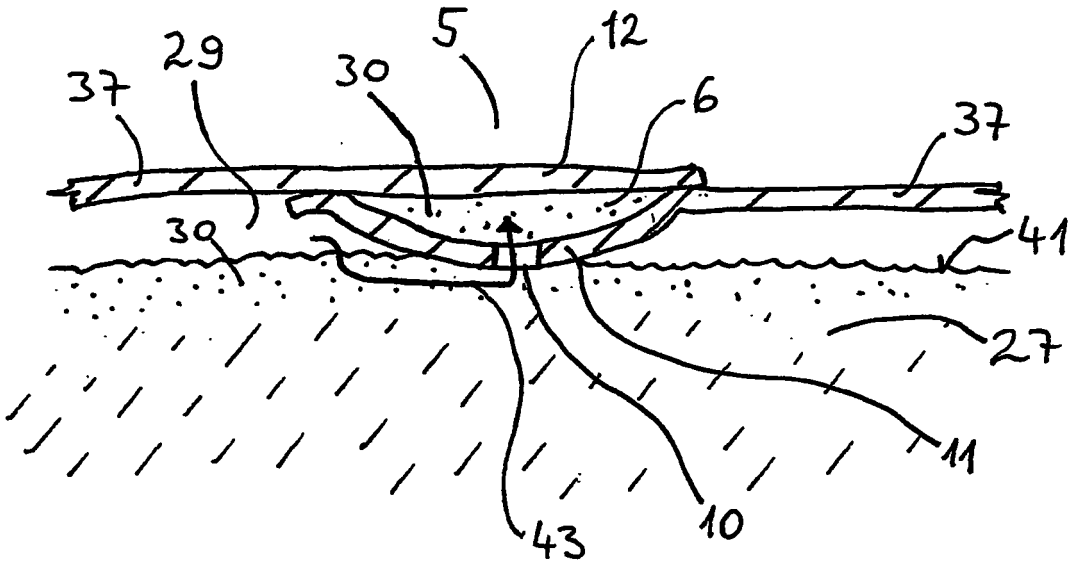


Fig. 11b
PRIOR ART

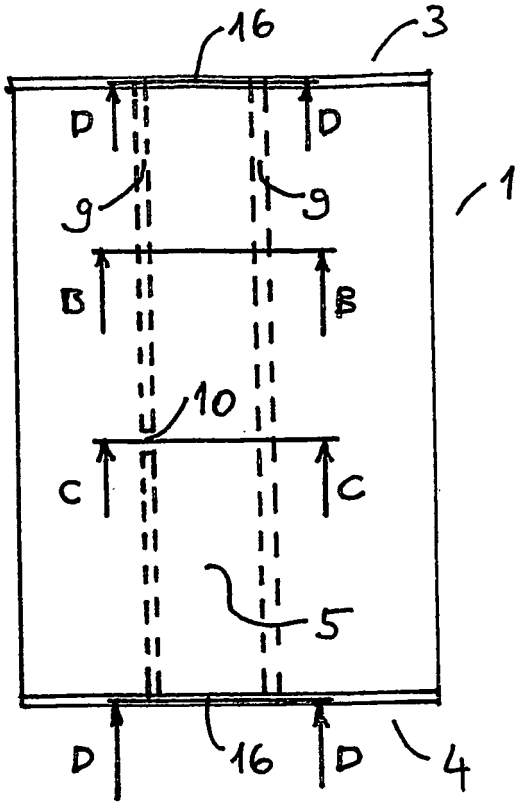


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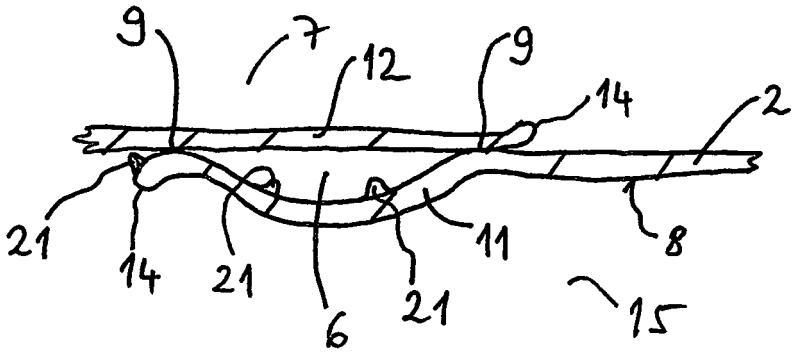


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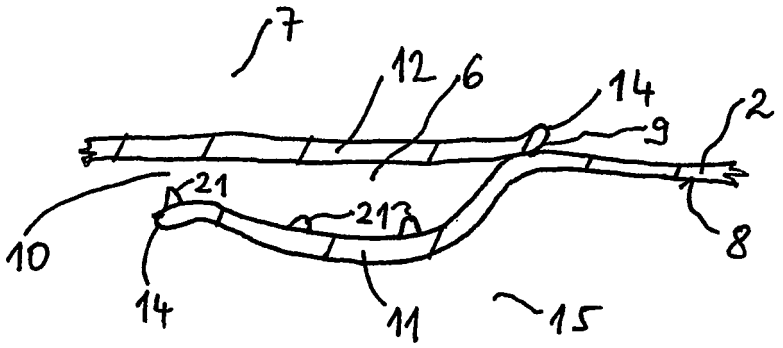


Fig. 12c

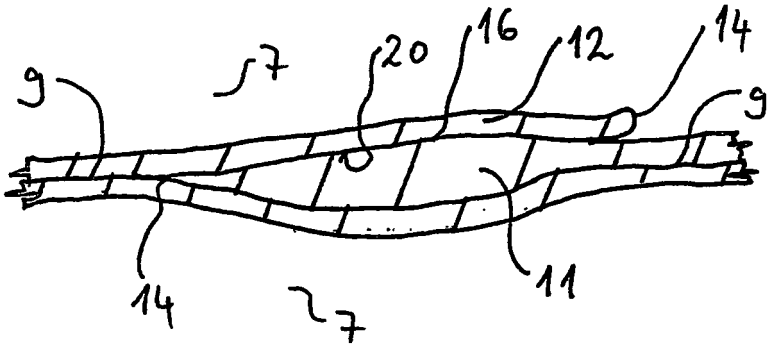


Fig. 12d

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3628720 A **[0002] [0007]**
- EP 1600399 A **[0002]**
- US 20070248291 A1 **[0002]**
- DE 8133295 U1 **[0002]**
- US 3937395 A **[0002] [0026]**
- EP 0444261 B1 **[0002]**
- US 5493844 A **[0002]**
- US 4441209 A **[0002]**
- US 4930904 A **[0002]**
- US 4672684 A **[0002]**
- DE G9110645 U1 **[0002]**
- DE 4033499 A1 **[0002]**
- WO 8808816 A **[0002]**
- WO 2005092724 A1 **[0002]**
- US 4759641 A **[0002]**
- US 20050281493 A1 **[0003] [0007] [0011] [0012] [0014] [0022] [0024] [0025] [0026] [0028] [0041]**
- US 20080257450 A1 **[0004] [0011] [0012]**
- US 2004188310 A **[0004]**
- DE 102007022400 **[0004]**
- US 4743123 A **[0026]**
- US 20080273820 A1 **[0026]**